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WILDLIFE IN NORTH CAROLINA

NORTH CAROLINA Wildlife RESOURCES COMMISSION

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An underwater view of tiger salamander eggs and larvae in a seasonal wetland on the Sandhills Game Land.
PHOTOGRAPH BY TODD PUSSER.

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WILDLIFE IN NORTH CAROLINA

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Cover: One goal of North Carolina's Candid Critters citizen-science program is to help biologists better understand the status of our state's deer population. PHOTOGRAPH BY RICK SMALL.

Wildlife in North Carolina is the official educational publication of the North Carolina Wildlife Resources Commission. It is dedicated to the sound conservation of North Carolina's wildlife and other interrelated natural resources and also to the environment we share with them.

EDITOR'S NOTE

TODD PUSSER

Todd Pusser has been to some amazing places during his 23 years as a marine biologist. He has visited every ocean basin, conducted surveys in the Arctic and Antarctic oceans, tagged beaked whales in the Mediterranean Sea off the coast of Italy and studied river dolphins on the Yangtze River in China.

Few projects have had Pusser as excited as his current one, right here in his home state of North Carolina. In his three-part series, Pusser gives our readers a rare underwater look at the biodiversity of life found in the broad spectrum of waters in North Carolina.

"North Carolina has such a wide range of aquatic subjects to take pictures of," Pusser said. "I wanted to show people how unique our aquatic environments are and how special they are."

Pusser's inspiration for the series is featured in "Rivers of Riches" (May/June 2018), which focuses on our mountain streams. In particular, Pusser highlights the brightly colored chubs and spawning minnows, fish he describes as "National Geographic material," which he had become fascinated with and determined to find and photograph.

"I received a lot of feedback on the first story, from people who just never knew there were so many colors in our area," Pusser said. "That makes me happy when people say that is so cool, that they had no idea we had that in our state."

Pusser's series continues this issue with life within the natural lakes and seasonal wetlands in the Piedmont. He will wrap it up in the Coastal Plain with photos of everything from sand tiger sharks to Neuse River waterdogs in the March/April 2019 issue.

Pusser grew up in the Sandhills and became interested in photography as a teenager after his parents gave him a Canon AE-1 35mm manual-focus camera. He learned through trial and error, always taking pictures in 35 millimeter. His passion for wildlife and photography grew from there, and he considers publishing articles in our magazine as a way to raise awareness about our state's wildlife opportunities.

"You don't have to travel to some exotic locale to see some spectacular wildlife," Pusser said. "You can see these incredible things right here within the boundaries of our state. Once people start to care, the natural progression is for people to want to protect what we have."

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Don't Fear the Rattler

I enjoyed the feature on timber rattlesnakes in the July/August issue and share Jeff Beane's fascination with these marvelous creatures. My wife and I have owned a 108-acre tract of woodland in Bladen County for some 14 years and I can't recall if I was more thrilled when first observing a wild turkey or a timber rattlesnake on the property. Deer and turkey sightings are regular and expected now but rattlesnake encounters make the day special. Normally I see one every year or so, most often in August or September, and invariably in thin cover on one of my bush-hogged roads. I always observe at a safe distance, take a few pictures and shake my head in wonder at what a near-perfect creation they manifest.

Just over a month ago, after turkey season was closed, I took an afternoon walk there for the exercise and to consider habitat improvements for deer and turkeys. It was a particularly memorable day as I first came across a small timber rattler (maybe 24–27 inches) coiled peacefully in a shady spot, and 30 minutes and 300 yards later, a larger specimen almost fully extended on the roadway. I estimated it to be 36 to 42 inches, typical of the size most-often encountered.

Many of my bow hunting and turkey hunting friends consider me demented for not killing rattlesnakes upon sight but I choose to share the woods with them. I consider them no threat as long as attention is paid to where I step. Unfortunately, the engrained fear of snakes in general and rattlesnakes in particular by the general public and even seasoned hunters makes life precarious for our dwindling rattlesnake population. The woods and swamps will be less vital and interesting when they are gone. Thanks Jeff for being an advocate of the timber rattlesnake.

Hayes Petteway
Elizabethtown

My highest compliments for Jeff Beane's article "Beleaguered Icon" in the July/August issue. I am recommending it far and wide, including to people who will probably not appreciate it. The article gets high marks from me for information, entertainment, humor, literary value—but especially for representing what I choose to think of as "enlightenment." I'm sure you have readers who will react negatively to this article for one reason or another, so kudos to both the author and the editorial staff for stepping up to the plate and serving your proper educational function.

Bill McLarney
Franklin

Hooked on Pier Fishing

I have been subscribing to WINC for almost all of my adult life, and I believe that your July/August edition may be my favorite. No one could read it without finding something of intense interest to them. The pier fishing article is my favorite. Six years old was I when I started leaning through the pier railings and dropping an old green cotton line down beside the pilings and watching my heroes pull up big flounder and that beautiful copper-colored fish with the black spot on its tail. Tha spot-tailed fish defined my life for the next 65 years. When I had enough money, I bought an old '69 jeep, built some Calcutta drum rods, used some hand-me-down Penn reels, and started surf fishing for those beautiful, big red drum. Took me years to learn the tricks of the trade and to read the water, but since then I have caught and released untold dozens of big red drum. I care absolutely nothing about off-shore fishing. Tried it a couple of times and even though no one loves the ocean more than I, I have a hardy respect for rogue waves, storms, sea sickness and human-eating creatures that call the ocean their home. I am too old and hurt too much to fish out of sight of my truck.

Even today, I cannot walk from one end of a pier to the other without feeling the excitement that I felt at the age of 6. Just watching the unhurried fishermen and fisherwomen fish, feeling the pier sway with the waves, hearing the ageless roll of the water and watching the waves swirl around the pilings is as therapeutic as it gets. Early morning, evening and night are priceless on a pier.

The late Jim Dean's pier article was the perfect ending to your wonderful magazine.

Steve C. Sink
Linwood

Name That Bat

About a month ago I saw a pair of bats in Beaufort County that were huge. I reread the article about bats in the May/June issue of *Wildlife in North Carolina* ("Battleground for Bats") in hopes I could identify these bats. I researched the four species listed in the article and nothing comes close to the size I saw. I know that at least one other person saw them, so it wasn't me alone. Another observation was they were flying in a straight line. So what kind of bat did I see?

William R. Waters
Pinetown

Katherine Caldwell, the Commission's bat biologist who was featured in the article about white-nose syndrome, took a stab at identifying the bat in question:

"It is difficult to identify bats in flight, but given the size reference, Mr. Waters may have seen a hoary bat. This is the largest bat in the state and is pictured on the first page of the article (page 34). Hoary bats typically fly in open areas and are not as maneuverable as their smaller-bodied counterparts, which are often found in forest interiors. Hoary bats are also migratory and can cover great distances, which could explain the bat's linear flight path."

write us

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A native son returns

WRITTEN BY **JACOB RASH**
PHOTOGRAPHED BY **THOMAS HARVEY**

The Commission is working to restore mountain streams and habitat to benefit populations of brook trout, North Carolina's only native trout

PATRICK CLAYTON/ENGBRETSON UNDERWATER PHOTOGRAPHY

What would you say if someone asked you for two words to describe the mountains of North Carolina? Would you call upon visits to individual places, think about images you have seen on postcards or remember the first time you touched a raised-relief map (you know, the fascinating 3-D maps that allow you to feel elevation changes)? Regardless of what shapes your description, chances are your vision of the mountains is one that captures its unique splendor.

What if the image and description you just formulated could be applied to a fish? If you could make that leap, I suspect you are envisioning an animal that must be special, beautiful and important to a lot people. Lucky for us, there is a fish that fits such a description: a brook trout.

As North Carolina's only native trout, brook trout have a biological significance. The amazing fish with distinctive markings and vibrant colors (especially in the fall) also have a long and storied history with mountain residents and visitors. Prior to the introduction of rainbow trout from the western states and brown trout from Europe, brook trout (also called specks or speckled trout thanks to their markings) were the only trout you could catch. As such, they were popular sources of food and sport for those lucky enough to encounter them.

However, as their habitats degraded and their populations mixed with non-native trout over the past 150 years, our brook trout have become far less plentiful in the mountains. So, the North Carolina Wildlife

Resources Commission is working to restore native brook trout populations through research (especially, genetic testing) and habitat improvements.

WHAT HAPPENED TO the Brook Trout?

Intensive logging practices of the 1800s and early 1900s introduced significant changes to landscapes across our mountains, and with that, there was much alteration to waters and the brook trout populations that lived within them. In some cases, well-intentioned individuals noticed that those pretty little fish that were once here are now gone, and they decided to bring some back by stocking some more. Unfortunately, that attempt to help had unintended consequences because the only brook trout available for stocking were from hatcheries in the Northeast, and by the 1920s, thousands upon thousands of this non-native, domesticated strain of brook trout were being stocked all over North Carolina. As a result, there was an introgression of those non-native hatchery genes into the remnant populations of brook trout, and in some cases, these introductions ultimately established populations of hatchery-origin fish.

Today, the Commission stocks approximately 300,000 brook trout annually for anglers within our Hatchery-Supported and Delayed-Harvest trout waters. The Commission does not stock on top of wild brook trout populations and only uses fish that are sterile and incapable of reproducing.

In addition to the historic brook trout stockings, the introductions of brown trout and rainbow trout were successful in establishing populations of each species, which now compete with brook trout for available food and habitat.

Through time, the loss of habitat has remained an issue for brook trout, which require clean and cold water. As watersheds become altered (for example, the loss of riparian zones, stream-crossing structures like culverts that prevent movement, increased sedimentation), conditions within the streams change and can shift away from the stringent biological requirements of trout species. Today, most of North Carolina's brook trout populations are relegated above barriers (often waterfalls or slides) within streams at least 3,000 feet above sea level, and the waters below the barrier are often occupied by the self-sustaining rainbow trout and brown trout stocked long ago.

IMPACTS OF Isolation

This retreat to the headwaters plays an important part in the story of brook trout and how the Commission develops plans to conserve the species. Certainly, a significant portion of the work involves finding where brook trout populations remain, and to date, the Commission has documented over 700 self-sustaining populations across the mountains. However, if we think back to those early brook trout stockings of hatchery fish, we know that just finding fish is not the whole story—there is additional work that

Opposite: Commission staff utilize backpack electrofishing systems to sample high-elevation streams. Brook trout can be distinguished by the olive-green coloration of the upper sides with mottled, dark green "worm-like" markings on their backs and tails. Above: Wild brook trout are often restricted to small headwater streams in the mountains. Below: Native brook trout are handled with care as research data is gathered.

Above: To collect samples, portable electrofishing probes are used to temporarily stun fish in the immediate area. A fin from a brook trout is clipped and the sample will be used for DNA testing.

is needed to examine genetic characteristics. Being essentially isolated within these headwater streams has not allowed brook trout to exchange genes with other populations to influence genetic fitness (something that would have occurred as populations overlapped and had access to each other).

One way to think about this is to consider a population's genetic makeup as a toolbox comprised of individual tools that could be used one day to address an issue. The more often genes are exchanged, the higher the likelihood that a population acquires another tool (they might not ever need to use it, but they will have it in their toolbox just in case). Without gene exchange, populations are left with the genes (tools) they have to survive and adapt to their environments. There are biological processes that take place to address this, but ultimately populations without effective gene flow are likely to be less genetically diverse (fewer tools). The Commission has spent a lot of effort to determine the genetic characteristics of our state's brook trout.

This information spans advances in genetic technology, but to date, we have contemporary genetic information on over 400 collections and 7,500 individual brook trout. Specifically, we have a foundation of conservation genetics data that describes genetic diversity and variation across the state, an understanding of relationships between populations and an assessment of the impact of all of those historic stockings.

At this point, our story of brook trout has focused primarily on genetics. We should, however, revisit the importance of habitat. Without the required habitat, any discussions relative to the fish are essentially moot, and given the limited distribution of brook trout, the importance of habitat is magnified. Just as we discussed with their genetics, the inability to connect to other waters restricts populations to their immediate environment, so if conditions become unsuitable, the fish cannot simply move to another water.

With that in mind, the Commission works with numerous partners (private landowners; local, state and federal agencies; non-governmental organizations; multi-state efforts like the Eastern Brook Trout Joint Venture) to maintain and improve these special aquatic habitats. Actions could range from ensuring proper streamside (riparian) shading to the removal of a culvert that prevents fish passage. The activities may seem minor, but they can have long-term impacts to the health of a stream. Specifically, it could mean maintenance of cold, clean water in the case of riparian zone management and increasing fish movement with barrier removal, which improves gene flow and access to available habitat.

PUTTING SCIENCE to Work

There are numerous other efforts underway relative to brook trout conservation, but we are very excited to take some of the

We have a foundation

OF CONSERVATION GENETICS DATA THAT DESCRIBES GENETIC DIVERSITY AND VARIATION ACROSS THE STATE...

information noted above to help us restore populations across their native range in the state. In particular, North Carolina now has one of the largest (if not the largest) state-level, genetic datasets to guide restoration efforts. Here is an example of how this information could be put to work:

A biologist may identify a stream with suitable habitat for brook trout, but for one reason or another, brook trout are not present today or non-native trout can be removed. One significant question is where to get fish to add to the stream slated for restoration. An approach could be to collect fish from the next closest stream and bring them to the destination stream once it is time to move brook trout. However, our genetics data allows us to make much better decisions.

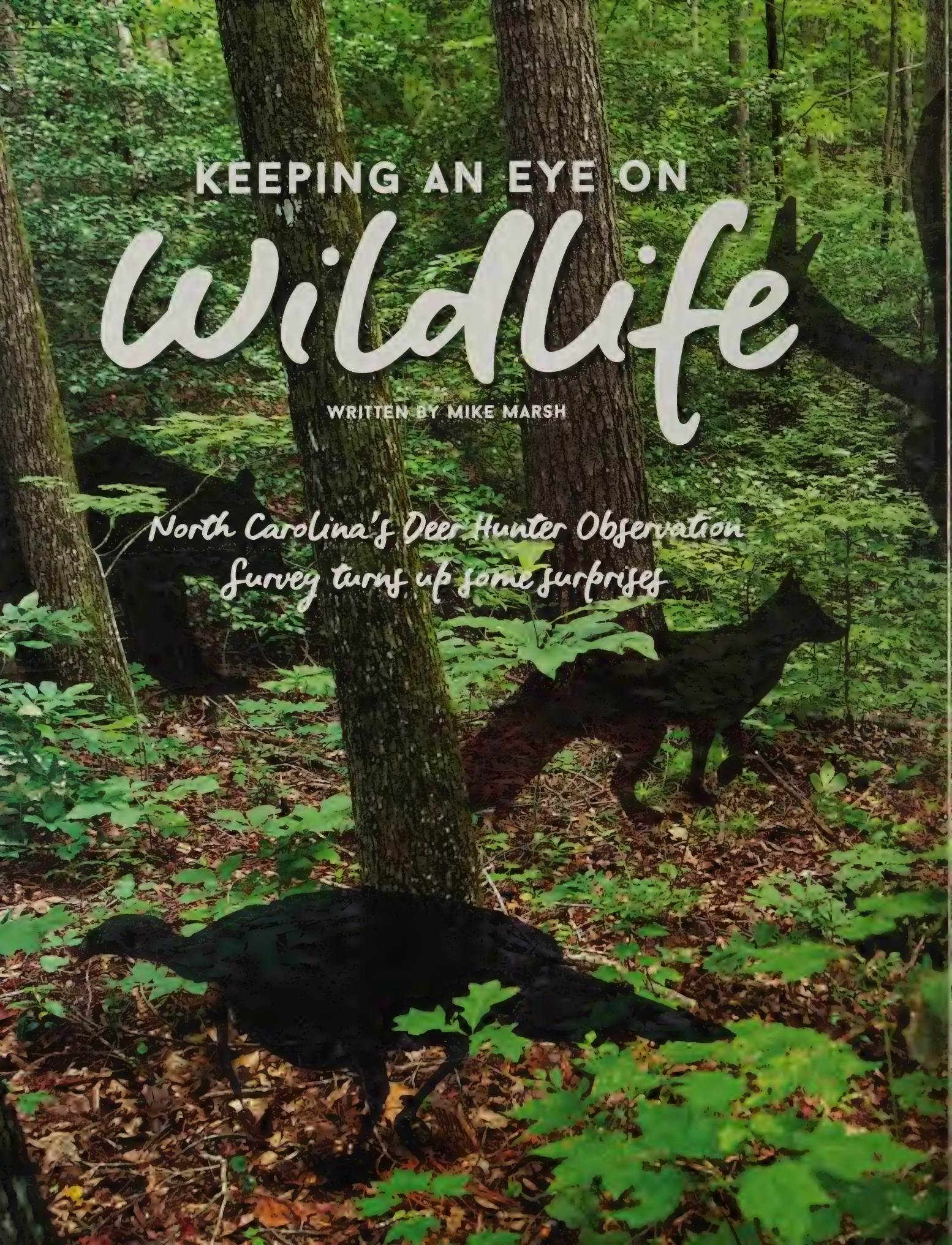
We can actually test potential source populations to see if there are any impacts from historic stockings (hatchery introgression) and to see other populations' genetic variables (seeing who might have the best available tools). Multiply that information across the suite of samples we have for the state and now the best populations can be picked as sources for our restoration efforts. This is of utmost importance because of the variation within and among watersheds. With this detailed information, we can make sure that we are utilizing fish without hatchery lineages and restoring only fishes with native genes that provide the best chance of success.

The goal of our research is to collect information that helps us make better decisions. In the case of brook trout, our recent discoveries have allowed us to transition into planning annual expansions of the species' historical range—we have two restorations planned this fall. By continuing to maintain and enhance suitable habitat, we can work to make sure existing and potential populations have places to live. Efforts like those to document the distribution and genetic makeup of populations also allow us to learn more about the native trout throughout our mountains. In the end, we have limited time and resources with which to work, so we want to make the best decisions possible for this species that means so much to so many.

We are continuing our efforts to conserve this beautiful and unique species. When we check back in 10 years to see how the 2018 restorations are doing, perhaps you will think of that amazing little trout high in the hills when someone asks you to describe the mountains.

Jacob Rash is the coldwater research coordinator for the N.C. Wildlife Resources Commission and an occasional contributor to Wildlife in North Carolina. *For more information on trout management activities, please visit ncwildlife.org/trout.*

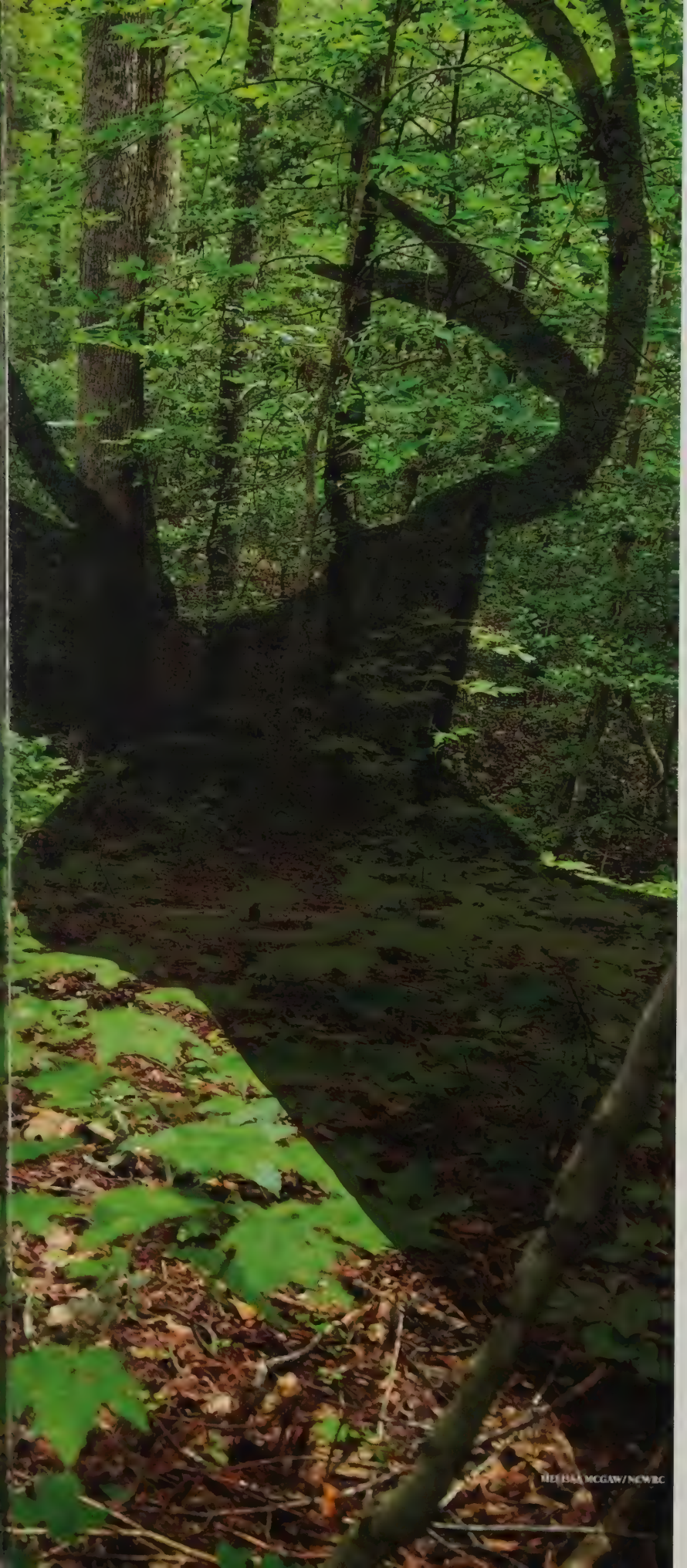
Clockwise, from top left: Jacob Rash, coldwater research coordinator for the Commission, records sampling data in his notebook. Wading boots are cleaned after use to minimize the chance of spreading invasive species or diseases from one stream to another. A brook trout is weighed and then measured. A biologist checks a trout's gills for gill lice, a parasite that can inhibit a fish's ability to breathe.



KEEPING AN EYE ON Wildlife

WRITTEN BY MIKE MARSH

North Carolina's Deer Hunter Observation Survey turns up some surprises



Over the past four deer hunting seasons, I can tell anyone how many deer I have seen while I was sitting in a ground blind or elevated stand. I also know the ages and genders of the deer and how many days and hours I spent observing not only deer, but all other major wildlife species. That's because I was one of approximately 1,000 hunters participating in the North Carolina Deer Hunter Observation Survey (DHOS).

It was as easy as filling in the blanks on a one-page form. While I have found the DHOS to be a simple way of tracking my animal sightings as well as a means of comparing the relative success of consecutive deer hunting seasons, biologists with the N.C. Wildlife Resources Commission are much more interested in what multiple observers are seeing. Now in the process of compiling and analyzing the fourth year of DHOS data, they will use it for a variety of reasons, including establishing wildlife trends that can help them propose changes in hunting regulations.

While deer hunters are the backbone of the DHOS, it began as a fox squirrel survey. When hunters began seeing fox squirrels in counties outside of the 27 that currently have a fox squirrel season, they requested an open season.

Chris Kreh was the first biologist to initiate a fox squirrel survey in North Carolina when he was the District 7 wildlife biologist. He is now the upland game bird biologist, but is spearheading discussion and analysis of the data regarding fox squirrel distribution and abundance gained through the DHOS.

TODD PUSSER

"The first time we changed fox squirrel season in modern times was when we added two counties, Ashe and Alleghany, in 2006–07," Kreh said. "When I started as District 7 biologist in 2006, we wanted to get more information on fox squirrels. So, I started an observation survey in 2008 and sent it to about 140 deer hunters so they could tell us anywhere they saw a fox squirrel. In 2009, we sent out a more detailed survey to deer hunters who were already working with us for a deer jawbone survey and they helped us through fall of 2012."

The positive outcome was that the Commission opened four more counties surrounding Ashe and Allegheny to fox squirrel hunting—Surry, Stokes, Watauga and Wilkes. In 2014, people who were seeing fox squirrels in Wilson and Halifax counties asked for an open season, laying the foundation for a statewide DHOS. Species-specific biologists added game and non-game animals to the survey list when they realized how effective deer hunters could be at providing new information or filling in knowledge gaps in existing surveys.

For example, Kreh said DHOS has given him a way of looking at turkey population numbers besides harvest numbers. The DHOS survey also tells him the number of turkey sightings per hour, another telltale tidbit of information not provided by observers participating in the Wild Turkey Summer Survey.

Dr. David Cobb, chief of the Commission's Wildlife Management Division, made the decision to move forward with the DHOS when he realized how effective it could be. One problem he foresaw was that participation requires significant time and effort, but hunter participation should increase when hunters begin seeing the positive results it could yield through expanded hunting opportunities and better management of game, furbearer and non-game species.

"I keep my own journals," Cobb said. "So, I know it takes a significant level of intent and dedication. We have learned through similar volunteer surveys that participation grows over time."

Cobb said the Commission held initial discussions about conducting a DHOS when Scott Osborne was the state's deer biologist more than a decade ago and deer hunters in Virginia were conducting a similar survey.

"It was the fox squirrel connection that gave it a good head of steam," Cobb said of the early surveys. "Fox squirrels were being seen beyond their historical range and we were looking for a good way to get information on their distribution."

The idea was to utilize a broad force of people to provide the Commission with information about what they were seeing and how much time they spend in the woods, especially in the context of different observations of different species.

"The DHOS is an additional data set to complement other surveys—one more piece of the puzzle," Cobb said. "But, the observations are not uniform across the state. For example, DHOS observers may not see some species we know are out there. They may also see species we do not know are there."

One such animal is the nine-banded armadillo. While armadillo sightings have occurred in several counties, no DHOS participant reported seeing one.

Ryan Myers is the Commission's survey and research biologist. He fits together nuts-and-bolts of various surveys and keeps them running smoothly.

"We were finally able to take a hard look at the DHOS after the first three years, 2014, 2015 and 2016," Myers said. "Hunters moved in and out of the survey each season. We are trying to maintain good distribution because we still have gaps."

Myers said the original invitations had bias toward fox squirrel data because more of them were sent to deer hunters in counties on the periphery of counties with a fox squirrel season than other counties. The selection process also recruited hunters based on participation in other surveys and from hunting license rolls, with most of them receiving invitations electronically. Going forward, he will tweak the invitation process so it targets more hunters in counties that have low, or no, representation in the DHOS to gain more information about deer, fox squirrels and other species of interest, down to the county level.

A NUMBERS GAME

Compiling and cataloging data from so many hand-written forms was tedious. However, it paid off, resulting in the first glimpse of what deer hunters are actually seeing while they are sitting quietly in the woods for hours on end. During the first three years of the survey, 1,000 deer hunters recorded wildlife species they saw during 73,000 trips with 205,000 observation hours. They hunted an average of 19.7 times, averaging 3.7 hours per hunt. Deer and gray squirrels were the most-sighted species, with hunters seeing an average of 753.1 deer and 724.1 gray squirrels per 1,000 hours. At the bottom of the tally were swine, with hunters observing 2.0 per 1,000 hours.

Jon Shaw, the Commission's deer biologist, said prior to the DHOS, biologists used three data sets to track deer population dynamics—the Hunter Harvest Survey, Big Game Harvest Reporting System and annual biological data collection activities. The DHOS is providing a fourth data set.

"The DHOS will help us keep tabs on the deer population," Shaw said. "What deer hunters shoot is completely different from what they see. Therefore, it is important that people know that we are not just relying on hunter harvest, which, while helpful, is not enough information for making management decisions. Assuming the average

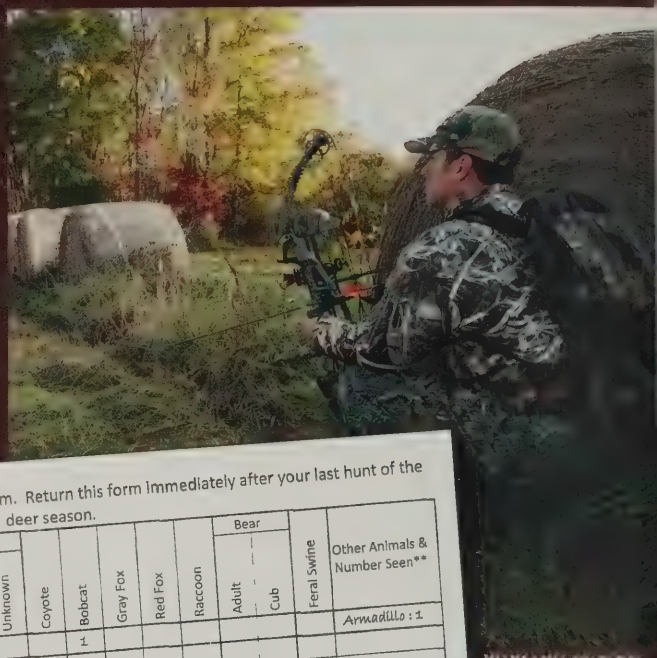
White-tailed deer

Participate
IN THE DEER HUNTER OBSERVATION SURVEY

Approximately 1,000 hunters annually have taken part in the DHOS, which is open only to deer hunters who hunt from stationary stands. So far, the Commission's outreach to potential participants has been primarily through electronic media. The Commission is interested in gaining observers in Districts 1 and 9, especially Graham and Swain counties.

Hunters who want to participate in the DHOS can request a survey form online at ncwildlife.org/DHOS. Participants will receive a survey form in the mail. Those who complete and return it will receive a DHOS summary.

To read the results of the Deer Hunter Observation Survey results, visit ncwildlife.org/Portals/0/Hunting/Documents/2016-Deer-Hunter-Observation-Survey-HunterSummary.pdf.



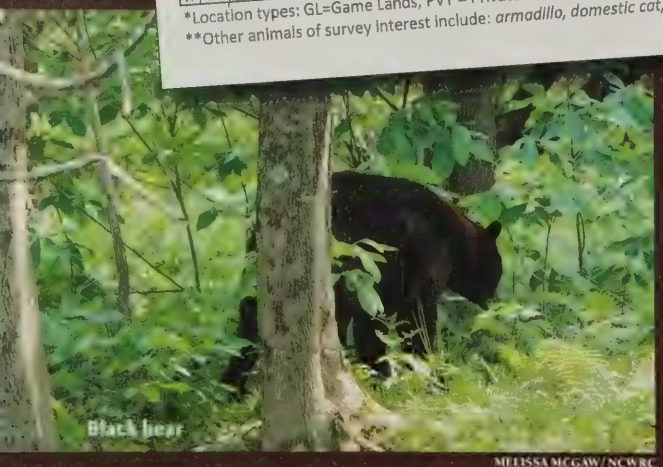
MELISSA MCGAW/NCWRC

Deer Hunter Observation Survey
North Carolina Wildlife Resources Commission

Please see instructions on the back of this form. Return this form immediately after your last hunt of the deer season.

Date	Hours Hunted	County	Location*	Hunt with Bait	Deer: Antlered Buck	Deer: Adult Doe	Deer: Button Buck/ Doe Fawn	Deer: Unknown	Squirrels: Gray Squirrel	Squirrels: Fox Squirrel	Turkey: Bearded	Turkey: No Beard	Turkey: Unknown	Coyote	Bobcat	Gray Fox	Red Fox	Raccoon	Bear: Adult	Bear: Cub	Feral Swine	Other Animals & Number Seen**
		Example	GL / (PVT)	Yes / (No)	1		2		10			1								1	2		Armadillo : 1
10/8/17	2.5	PENDER	GL / (PVT)	(Yes) / No											1							
09/30/17	3.5	BLADEN	(GL) / PVT	Yes / (No)																		
09/30/17	3.0	PENDER	GL / (PVT)	(Yes) / No				1														
10/01/17	2.0	BLADEN	(GL) / PVT	Yes / (No)																		
10/02/17	3.5	PENDER	GL / (PVT)	(Yes) / No											1							
10/03/17	2.0	PENDER	GL / (PVT)	(Yes) / No																		
10/04/17	1.0	PENDER	(GL) / PVT	Yes / (No)					2													
10/11/17	4.0	BRUNSWICK	(GL) / PVT	Yes / (No)																		
10/13/17	4.0	PENDER	GL / (PVT)	(Yes) / No				1			1											
10/14/17	6.0	PENDER	(GL) / PVT	(Yes) / No																		
10/15/17	8.0	PENDER	GL / (PVT)	(Yes) / No					1													
10/16/17	2.0	PENDER	GL / (PVT)	(Yes) / No		1	2		2													
10/17/17	3.0	PENDER	GL / (PVT)	(Yes) / No			1		1													
10/19/17	2.0	PENDER	GL / (PVT)	(Yes) / No	1		3												1			
10/24/17	4.0	PENDER	GL / (PVT)	(Yes) / No	2		2		1													
10/23/17	1.0	PENDER	GL / (PVT)	(Yes) / No					2													
10/24/17	3.0	PENDER	GL / (PVT)	(Yes) / No					1													
10/25/17	1.0	PENDER	GL / (PVT)	(Yes) / No					2													
10/28/17	3.0	PENDER	GL / (PVT)	(Yes) / No	2				3													
11/02/17	2.0	PENDER	GL / (PVT)	(Yes) / No			1		1					2								
11/04/17	3.0	PENDER	GL / (PVT)	(Yes) / No			1		3													
11/05/17	3.0	PENDER	GL / (PVT)	(Yes) / No	1				3					2								
11/07/17	2.0	PENDER	GL / (PVT)	(Yes) / No	1		1		1					8								
11/09/17	3.0	PENDER	GL / (PVT)	(Yes) / No					1													
11/10/17	4.0	PENDER	GL / (PVT)	(Yes) / No	1																	
11/11/17	4.0	PENDER	GL / (PVT)	(Yes) / No																		
11/14/17	2.0	PENDER	GL / (PVT)	(Yes) / No					1					3	2							
11/21/17	1.5	PENDER	GL / (PVT)	(Yes) / No					2													
11/22/17	1.0	PENDER	GL / (PVT)	(Yes) / No				2														
11/26/17	2.0	PENDER	GL / (PVT)	(Yes) / No					1													
11/27/17	1.5	PENDER	GL / (PVT)	(Yes) / No																		

*Location types: GL=Game Lands, PVT = Private Land or other property not in the NC Game Lands Program
**Other animals of survey interest include: *armadillo, domestic cat, elk, mink, red squirrel, spotted skunk, and weasel*



Black bear

MELISSA MCGAW/NCWRC

WHAT HUNTERS HAVE SEEN

Animals seen by deer hunters participating in the survey per 1,000 hours in 2014–16

All Deer *(including unknown age/sex)*	753.1	Coyote	20.0
Gray Squirrel	724.1	Fox Squirrel	17.9
Doe Deer	373.5	Adult Bear	11.6
All Turkey *(including unknown beard status)*	366.0	Gray Fox	8.6
Non-bearded Turkey	181.5	Juvenile Bear	5.9
Fawn Deer	162.5	Red Fox	3.6
Antlered Buck	147.9	Bobcat	3.3
Bearded Turkey	66.5	Swine	2.0
Raccoon	26.3		

Coyote

F. EUGENE HESTER

hunter can distinguish between a year-and-a-half-old doe and a fawn, the DHOS will help us detect changes in doe age structure and how much pressure we are putting on females and buck age structure and how much pressure we are putting on males.

"The data from the DHOS has fallen in line with lactation data we already have and should help us write a prescription for the future by providing baseline data. It may even show that a doe harvest of 30 percent of the population, a traditional guideline, may no longer be sustainable."

One of the most important parts of the deer puzzle is recruitment, which is the number of fawns entering the huntable population. The DHOS, while not truly scientific because participation is not on a map-grid basis, showed a statewide ratio of 0.6 fawns per doe, similar to other states in the Southeast. However, in North Carolina, it varied substantially by region.

Shaw said Virginia has a longstanding bowhunter survey that showed a similar fawn-per-doe ratio until coyotes appeared. Had North Carolina's DHOS been in place before coyotes appeared here, it could have documented impacts coyotes may be having.

"The DHOS deer-seen-per-hour rate was about 0.7," Shaw said. "If there is another hemorrhagic disease outbreak, we will be able to see any decline in that rate as a compliment to our harvest data. What we don't know is how much hunter effort changes during these disease outbreaks. Hunters may hunt less or could just be less likely to pull the trigger. The DHOS can help to tell us that. We also do not know if the DHOS truly measures recruitment. We would love to perform a deer ecology study and put GPS collars on fawns, does and bucks in North Carolina and compare it to information from the DHOS to find out."

A TOOL FOR REGULATION

Colleen Olfenbuttel is the Commission's black bear and furbearer biologist. She said the habits and low populations of these mammals are reasons for their low sighting numbers recorded in the DHOS.

"The species in my program, such as bobcat, foxes, coyotes and black bear, have relatively low observations compared to animals like deer and gray squirrels because they are more nocturnal and not as abundant," Olfenbuttel said. "Therefore, we do not really have enough data, after only three years, to see trends on a statewide level. Over time, however, we should be able to compare statewide population trends to what we see with other surveys, making all of our surveys more effective at monitoring our wildlife populations."

An example of furbearer survey corroboration is the Raccoon Hunter Survey. Conducted since 1987, it provides long-term monitoring of raccoon populations. During field trials, raccoon hunters record how many raccoons they tree per hour of hunting.

"Over time, it tells us whether the population is going up, down or remaining the same and gives us the data for different regions of the state," Olfenbuttel said.

"Hunters participating in the DHOS will help us generate data that will help us validate the relationship between raccoons observed during field trials with observations made by deer hunters."

Another challenge leading to low furbearer and black bear observation rates is low DHOS participation that may prevent biologists from making strong inferences about certain species, even on a regional level.

"The DHOS is a great way for hunters to become more involved in the process of managing our wildlife," Olfenbuttel said. "The data these volunteers are providing would otherwise cost us millions of dollars in the form of population research projects. We would never have the budget or staffing levels to accomplish that.

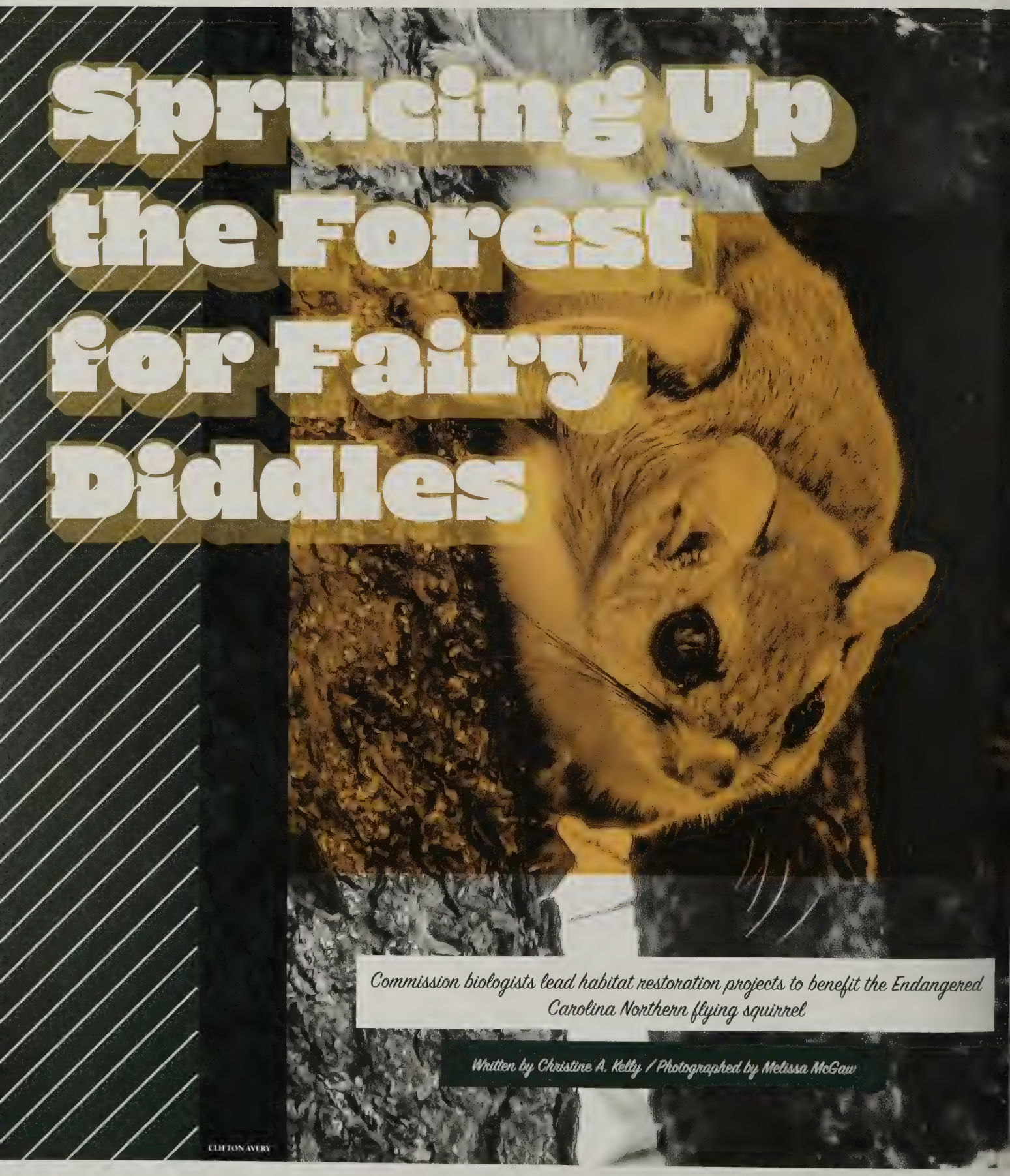
"In addition, there is a lot of interest in fox and coyote populations. This survey, with more participation from hunters, will give us better data to help form management decisions and recommendations."

So, did the DHOS live up to its primary goal, which was turning up any upticks in fox squirrel range or populations? Indeed it did, with DHOS participants seeing fox squirrels in 50 counties at a rate of 17.9 observations per 1,000 hours.

"We will be looking closely at the first four years of DHOS data to figure out what may be appropriate changes to our fox squirrel hunting regulations," Kreh said. "It is telling us there are good populations in more places than where they historically occurred. We will use that information along with other data sets regarding squirrel hunting, fox squirrel hunting and harvest. We could propose more opportunities to hunt fox squirrels in the future.

Mike Marsh is a freelance writer and a longtime contributor to Wildlife in North Carolina. *For more information about his work, visit mikemarshoutdoors.com.*

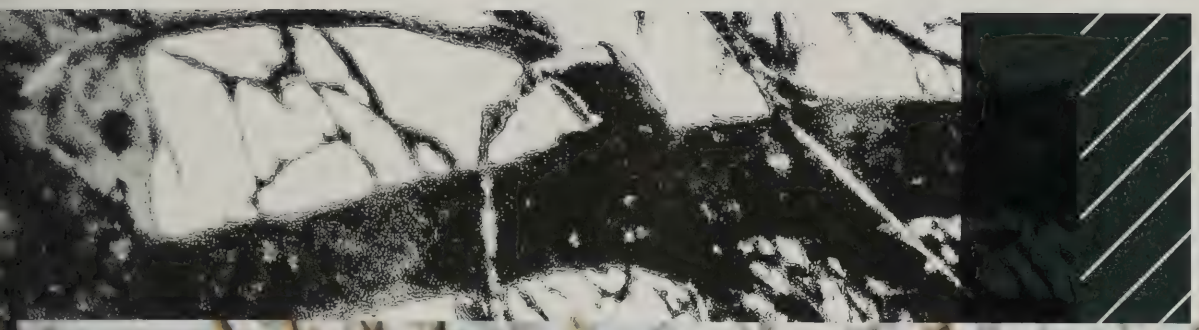
Sprucing Up the Forest for Fairy Diddles



CLIFTON AVERY

Commission biologists lead habitat restoration projects to benefit the Endangered Carolina Northern flying squirrel

Written by Christine A. Kelly / Photographed by Melissa McGaw



"Stand still! Stand still!" I command.

The flailing student comes to a halt but hasn't shaken the long-tailed furry brown hitchhiker clinging to his pant leg: a flying squirrel.

"It won't bite. It just needs a launch point," I say. The flying squirrel scurries up the front of the kid's sweatshirt to his shoulder, pauses to gather itself, then launches into the air. In its panic, it lands short of the nearest tree trunk but scrambles the last few feet, bolting behind it, then dashes up the trunk. From a branch it peers down, its big black eyes blinking at us.

The rest of the students, giggling a few seconds ago, are now hushed with mouths agape, staring back at it. Someone steps closer with a camera and the flying squirrel jumps, floating off in a slow glide down the mountainside. Demonstrating remarkable maneuverability, it banks a hard left to sail past a tree branch and out of sight. The whole course of its glide, which lasts seconds, is accompanied by a chorus of "whoa!" and "that was awesome" and awed laughter.

It is like that every time. There's something magical about a flying squirrel. No wonder its folk name is "Fairy Diddle." I prefer to call them "flyers."

I turn back to the class of aspiring wildlife biologists who attend Haywood Community College. They are helping me check squirrel boxes in the Great Balsams, just up the road from their campus in Clyde. I had just finished measuring and tagging this flying squirrel and put it back in its nest box. I can't make a scurrying sciurid stay put though. This one busted out and dropped to the forest floor right smack in the middle of 20 students, cueing a teachable moment.

"Flying squirrels aren't capable of powered flight," I say. "They glide by pushing off with powerful hindquarters, extending their fore and hind legs, and spreading out their patagium." I demonstrate the patagium (or "wing" membrane) with my arms wide. "To do this, they need a tree for launching." I turn to the student who served as a human launch beam. His expression lies halfway between amused and embarrassed. "Or something tall that serves the same function. An Endangered species just used you as a launch tree. Consider yourself lucky."

Actually, each student was fortunate that day. Sometimes we check boxes without finding any squirrels. Just 10 percent of the roughly 350 boxes checked each winter are occupied. This is no ordinary flying squirrel. It's the Carolina Northern flying squirrel, a critter you are only likely to see if you're really looking for it.

Flyer 101

North Carolina is home to two species of flying squirrels. Both species of these gliding tree squirrels are nocturnal cavity-dwellers. The smaller, grayish-brown Southern flying squirrel is found throughout North Carolina at mid to low elevations, where it subsists on nuts and seeds. The rarer Carolina Northern flying squirrel dons a cinnamon-brown coat and is found only on 13 massifs in North Carolina, Tennessee and Virginia's highest mountains.

In 1985, the U.S. Fish and Wildlife Service listed the Carolina Northern flying squirrel as Endangered, due to its limited and discontinuous range making it vulnerable to habitat destruction, fragmentation or alteration. Biologists noted particular concerns about past and future clearing of forests, introduced insect pests such as the Balsam woolly adelgid, recreation and other development, pollution (heavy metals, pesticides and acid rain) and the potential for global warming further limiting its range.

Despite their similar appearance and ability to glide, North Carolina's two flying squirrels differ in key aspects of their ecology. The Carolina Northern flying squirrel lives in North Carolina's so called boreal forest zone, selecting cool, moist, north-facing slopes. Its haunts are the dark spruce, fir and birch forests above 4,500 feet elevation. There, it consumes truffles, buds, fruits, lichens and anything from bird eggs to nestlings to crayfish.

NATURE'S WAYS

How Do Flying Squirrels 'Fly?'
See Nature's Ways, page 43.

Our acoustic surveys and radio-telemetry tracking data have made it clear that Northern flying squirrels prefer mature conifers. In fact, according to research by Dr. Cordie Diggins and Dr. Mark Ford of Virginia Tech, Carolina Northern flying squirrels have smaller home ranges in high-quality habitat of taller conifers, foraging nightly in the spruce and fir. Why so? The answer may have something to do with the truffles they eat.

As if its gliding ability was not captivating enough, this flying squirrel's role in forest dynamics is also fascinating. At night, they parachute down from the trees to dig for truffles, the fruiting bodies of mycorrhizal fungi associated with the roots of spruce trees. The mycorrhizae form a fibrous net around the roots of the tree, helping the tree capture water and nutrients. The fungus in turn obtains sugar from the tree.

To a flying squirrel, the tasty, nutritious part of the truffle is the tough outer skin. However, they inadvertently ingest some of the spores at the center of a truffle. The undigested spores are dispersed across the forest floor in the flying squirrel's droppings. Other small mammals, such as red-backed voles, do much of the same. However, the flying squirrel's unique gliding locomotion enables it to cover larger areas, dispersing spores broadly. Thus, Dr. Peter Weigl, the preeminent authority on the Carolina Northern flying squirrel, noted that it effectively perpetuates its own habitat. But in some parts of their range, where past land use has drastically altered the forest, the flying squirrels can't do it alone. They need our help.

Changing Times and Trees

On a chilly mountain morning in June, my crew is parked at Black Balsam, donning winter coats and hats. Joining us is volunteer Julie Wade, a wildlife student at Haywood. I fit Julie with an external frame backpack to which I have strapped three ammo cans housing devices that will record the vocalizations of flying squirrels. We're collecting baseline data on flying squirrels in an area slated for habitat restoration. In a few months, we'll be planting nearly 1,000 red spruce seedlings with the help of Julie and her classmates.

First, we want to see if Northern flying squirrels persist here. I have my doubts because the habitat is degraded. Between 1905 and 1920, spruce was logged from every corner of Haywood County's high mountains reachable by railroad. The extraction did not employ the sustainable practices used today. In several areas, including the forest we're about to survey, the slash caught fire. Raging fires in 1925 and 1942 incinerated soil and led to erosion during storms and freeze-thaw cycles. Thus, the loss of habitat that led to the Carolina Northern being listed as Endangered happened over a discrete window of a mere few decades. Mind you, no one even knew about the Carolina Northern flying squirrel back then. It wasn't discovered in North Carolina until 1953.

Across this moonscape of eroded soils, a forest began to recover, only it was not the same forest as before. The spruce-fir forest is not a fire-adapted community. The normal forest dynamics here occur at the scale of individual tree fall gaps. In this newly cleared, soil-depleted setting, acres of blackberry and pioneer hardwoods like fire cherry replaced the spruce and fir that had once grown alongside yellow birch and sugar maple. The forest we now survey

Opposite, left to right: Chris Kelly, a wildlife diversity biologist for the Commission, holds a female Northern flying squirrel caught in Haywood County. Next, Kelly weighs the flying squirrel as part of her research. Middle: Flying squirrels chew raw birch bark down to fine strips to create nesting material. Kelly checks a nesting box for flying squirrels at the Buckeye Creek site in Haywood County. Kelly takes a flying squirrel's measurements.

Biologist Chris Kelly records data in a notebook. Bottom: Both species of flying squirrels that live in North Carolina are nocturnal cavity dwellers that den in trees. The Northern flying squirrel lives in forests of yellow birch and red spruce like this one being planted with spruce seedlings.

features a canopy of 70-year-old yellow birch, with mid-story birch, sugar maple and buckeye. Spruce occurs in small clumps, with some individuals reaching the canopy, but the majority in the mid-story shaded by hardwoods.

That spruce and Carolina Northern flying squirrels persist here seems unlikely. But they have, thanks to flexibility in their life histories. For example, the Northern flying squirrel is not restricted to conifer forests or a diet of truffles; they will use Northern hardwood stands in the absence of conifers and eat a varied diet. Likewise, while red spruce grows faster in the sun, it is not restricted to open areas. Spruce is remarkably shade tolerant. Individuals sometimes sit in the shade of hardwoods for 50 to 100 years ready to grow into the next tree fall gap. And so both remain, but over a much shrunken range and in a heavily altered forest.

But their plasticity has its limits. One threat the Northern flying squirrel faces is upslope encroachment by the Southern flying squirrel. Unlike the Northern flying squirrel, which can subsist on the nutritious oils of Usnea lichens when the snow piles up, the Southern flying squirrel's small body size demands a constant, cacheable supply of nuts and seeds to survive winter's cold. The lack of such a source of hard mast in the spruce zone seems to limit Southerns from becoming established there as a year-round resident. Warmer winters may increase contact between the two species, as the Southern flying squirrel ventures upslope, bringing with it the parasitic intestinal worm *Strongyloides robustus*. The Southern flying squirrel fares well when infested by this parasite, but the Northern flying squirrel does not.

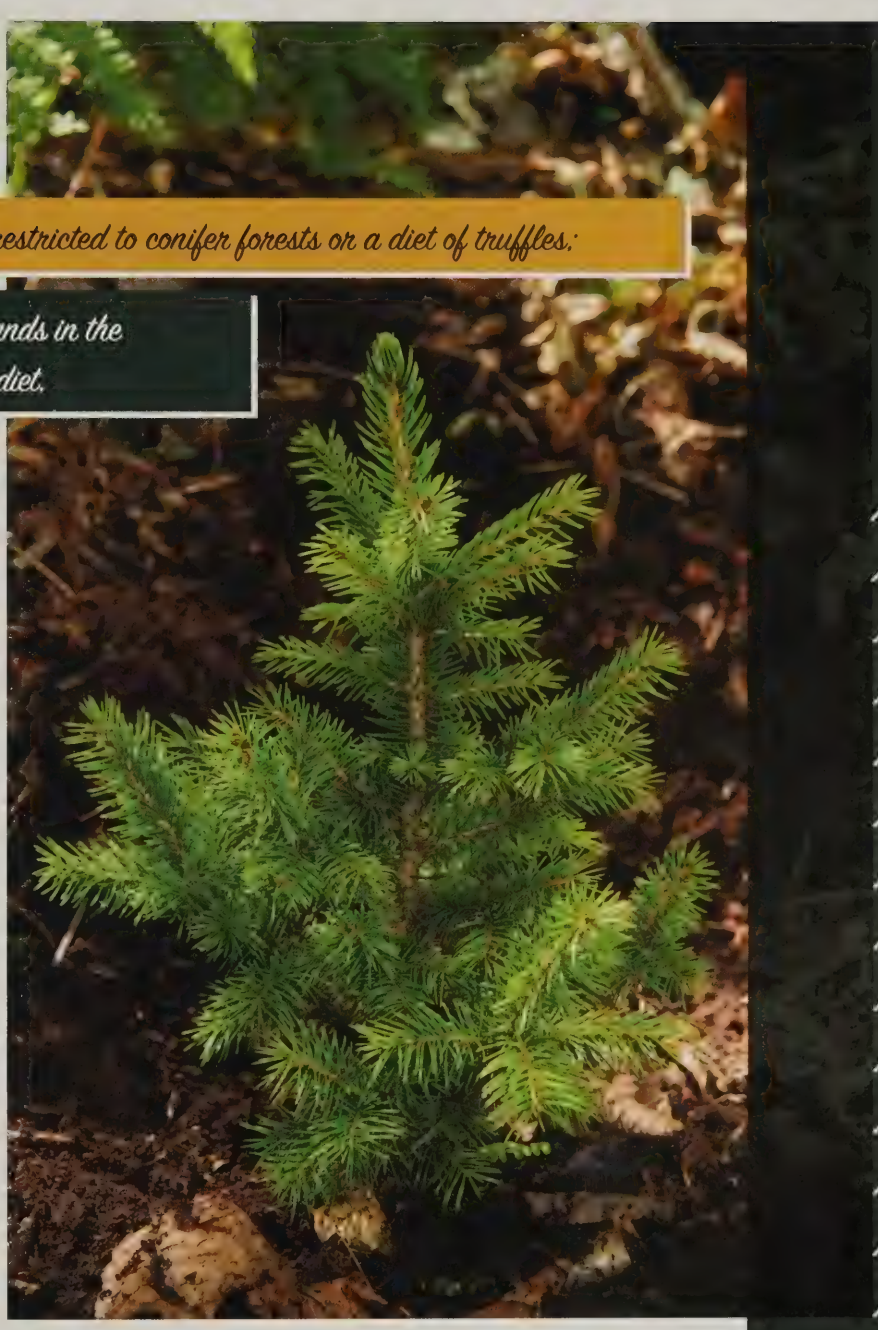
Planting for the Future

A healthy, robust Northern flying squirrel population needs high-quality, well-connected forest habitat. Restoration of this forest community is the mission of the Southern Appalachian Spruce Restoration Initiative (SASRI), which formed in 2012 and is a partnership among agency biologists, non-governmental organizations, university researchers and nonprofits. SASRI partners guide restoration objectives and propagation, planting and monitoring efforts. One of SASRI's objectives is to restore conifers to hardwood-dominated stands, creating a mixed forest. Another goal is to restore connectivity between patches of high-quality habitat to enable dispersal of the squirrels.

In some areas, large swaths of blackberries separating forest patches exceed the flyer's glide distance (and tall students are unlikely to be standing at the ready as squirrel launch pads). Squirrel-sponsored spore spreading may achieve these objectives, but at a snail's pace and only in those areas having a spruce seed source. Biologists and foresters can speed up the process by planting spruce seedlings where they are scarce and releasing existing seedlings to sunlight to accelerate growth. Release is accomplished by selectively cutting hardwood trees shading vigorous spruce trees in the understory.

The Northern flying squirrel is not restricted to conifer forests or a diet of truffles;

they will use Northern hardwood stands in the absence of conifers and eat a varied diet.



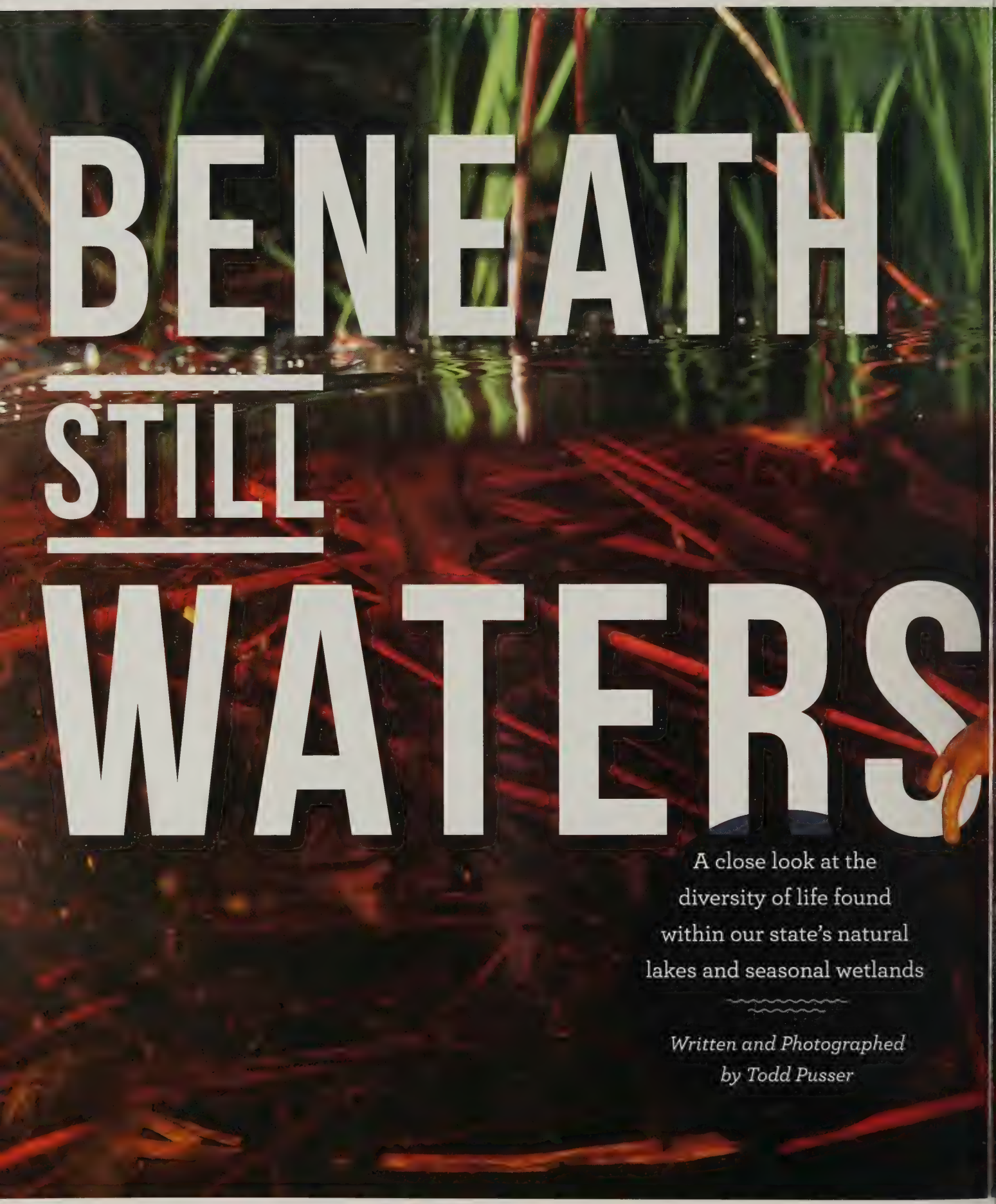
First though, we need seedlings—preferably locally-sourced seedlings. The nearest are in West Virginia, so we grow our own. Each autumn, I find myself crouched beneath towering spruce trees, picking fresh red cones off the forest floor and dropping them into brown paper bags. Fingers sticky with sap, I leave the cool mountain top to deliver my cone haul to The Southern Highlands Reserve, a native plant arboretum and research facility on Toxaway Mountain in Transylvania County. Their small staff have grown spruce for 10 years and are experts at extracting seed from cones, cataloging the germinating plants and growing such vigorous seedlings that they prefer to call them small trees.

Since 2013, spruce has veritably taken over the Reserve's nursery space. The four restoration efforts implemented thus far clear out the nursery in a matter of hours as partners load trucks and trailers with trees bound for the woods. The experience leaves Southern Highlands Reserve Director Kelly Holdbrooks reeling with a mix of excitement for contributing to conservation and sadness to see the trees go. Her sadness is short-lived as she turns around to start the next batch of seedlings that will be needed.

In September, we're back at the Black Balsam parking lot having just cleared out the Reserve's seedling stock. The restoration site is 1 mile from the parking lot. Volunteers from hiking clubs and trail maintenance crews spend two days hauling seedlings down the trail. Haywood instructor Shannon Rabby distributes hard hats and shovels to his forestry students. Everybody leaves the parking lot with a sack of red spruce seedlings. The seedlings are freshly watered, weighing that much more.

The students bring enthusiasm to the planting days, despite having never seen a Carolina Northern flying squirrel. They plant the trees quickly (hoping to exceed the number planted by Warren Wilson College's forestry crew which will plant later that week) but they plant with care. Throughout, they pepper me with questions and ideas about release work and monitoring. Their forestry education comes to life with each seedling they bury in the ground. A few muse that they want to see these trees in 30 years. And of course, they all want to see a Carolina Northern flying squirrel. So, I invite them back to help me check squirrel boxes in the winter. I can't promise we'll catch any Northern flying squirrels, but if we do, maybe someone will be lucky enough to serve as a launch pad.

Christine A. Kelly is a wildlife diversity biologist based in the Mountains, where she oversees conservation efforts for nongame birds and the Carolina Northern flying squirrel. She is an occasional contributor to Wildlife in North Carolina.



BENEATH STILL WATERS

A close look at the diversity of life found within our state's natural lakes and seasonal wetlands

Written and Photographed by Todd Pusser

Eastern Spadefoot Toad

PART one in this three-part series examining the diversity of life in North Carolina waters focused on mountain streams ("Rivers of Riches," May/June 2018). Habitats with running or flowing water, such as streams, creeks and rivers, are defined as lotic environments. Lentic environments are places where water stands still, such as ponds, lakes and swamps. This second installment provides a general overview of two very different lentic waters found in our state—natural lakes and seasonal wetlands. Both environments provide critical habitat for a wide variety of plant and animal life. Aside from dedicated biologists, few take the time to examine these waters from beneath the surface.

Dappled sunlight, filtered by a canopy of oak and pine trees, illuminated the trail I was walking that late March afternoon a few years back behind my parents' house in the Sandhills. Steady rains during much of the previous week had given way to clear blue skies and unseasonably warm temperatures. The doldrums of winter were finally starting to slip away.

It was the shrill piping of spring peepers up ahead in the distance that first drew my attention. The frogs, as their name suggests, are the quintessential harbingers of spring and their voices are great indicators of nearby wetlands. Curiosity got the best of me and I diverted off the well-worn trail to see what all the ruckus was about.

After walking a hundred yards or so and fighting a dense tangle of smilax vines, I stepped into a small clearing. Stretched out before me was a small woodland pool, not much bigger than my living room. The peepers, sensing my presence, immediately stopped their chorus.

Despite hiking these woods for years, I had never seen this small body of water. Examining the pool, I noticed that the water was crystal clear and maybe 12 inches deep. As I walked around the water's edge, I immediately noticed large, gelatinous masses, each about the size and shape of a baseball and packed with hundreds of dark eggs. All the egg masses were just below the surface of the water and attached to fallen branches or sedge stems. Thanks to the raucous calls of the tiny frogs, I had stumbled upon one of North Carolina's least known but most important biological sources of water: a seasonal wetland.

Slowly circling the pool, I counted over 80 egg masses, all of which appeared to have been laid at roughly the same time. Motion beneath the surface of the water quickly drew my attention. Out from beneath an egg mass swam a creature nearly 9 inches long covered in sun-yellow spots. With a few quick swipes of its tail, the salamander quickly disappeared beneath the leaf litter at the bottom of the pool, leaving me feeling pleasantly surprised. I spent much of my youth roaming these woods, turning over every log in sight, and never encountered a spotted salamander here. I had no idea that the species occurred so close to my childhood home.

Here Today, Gone Tomorrow

Seasonal wetlands, as their name implies, are temporary bodies of water that form in slight depressions across the landscape. Varying in size and shape, they are filled by fall rains, winter snowmelt and spring showers, lack any species of fish, and typically dry up during the long hot days of the Carolina summer. Also called vernal pools, ephemeral ponds, bogs, potholes and Carolina bays, seasonal wetlands are among the most productive of our state's ecosystems, providing habitat for numerous species of plants and animals.

"Approximately 40 to 45 percent of the state's amphibian species have been known to breed in or otherwise inhabit ephemeral wetlands in North Carolina. At least 14 species are entirely dependent on them," said Jeff Beane, curator of reptiles and amphibians at the North Carolina Museum of Natural Sciences. Among them are our state's most spectacular amphibians, including tiger salamanders, marbled salamanders, spotted salamanders, gopher frogs, barking treefrogs and wood frogs.

Seasonal wetlands also provide crucial habitat for numerous invertebrates, from caddisflies and dragonflies to crayfish and fairy shrimp. Shorebirds, such as spotted sandpipers, make stopovers in them to

▶▶

Opposite: Sunlight shines through the gelatinous egg mass of a spotted salamander in a small woodland pool in Moore County. The shallow waters of seasonal wetlands, free of predatory fish, provide ideal habitat for many species of amphibians including the spotted salamander.

feed on the insects and amphibian larvae, as do land predators like raccoons, foxes and black bears. Chicken, painted and snapping turtles forage in pools that collect water during the autumn, sometimes even hibernating in them.

Plants that tolerate both dry and wet conditions, such as grasses and sedges, are prevalent in seasonal wetlands. The flowers of redroot and white meadow-beauty sprout during dry periods. During years with heavy rainfall, aquatic plants such as water lilies, water shield and yellow bladderworts thrive in their warm, shallow waters.

Due in large part to their ephemeral nature and small size, seasonal wetlands are often overlooked and vastly underappreciated. They rarely show up on topographical maps or on Google Earth. Historically, seasonal wetlands were viewed as nuisances, breeding sites for mosquitoes, or as a rich soil source for farming.

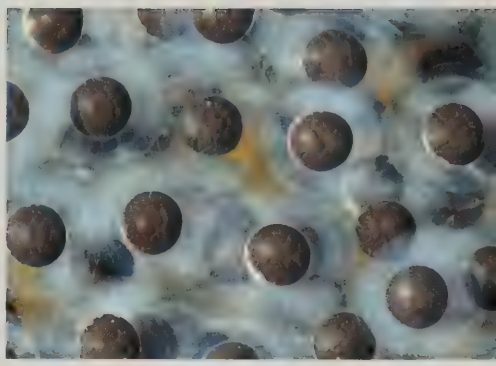
"Their small size affords them less regulatory protection compared to other wetlands," said North Carolina Wildlife Commission Biologist Jeff Hall. "Many have been lost to development through outright filling of the ponds, or deepening to be made into fish ponds. As such, remaining isolated seasonal wetlands on the landscape are extremely important and worth extra conservation efforts to preserve them."

Among the largest seasonal wetlands in North Carolina are the Carolina bays found in portions of Hoke, Scotland and Robeson counties. With names like Antioch Church Bay, Goosepond Bay and Tunstall Bay, these clay-based wetlands, each dozens of acres in size and surrounded by broad sand rims and bay trees, were once the strongholds for many species of rare amphibians in the state. Though many are protected by the Nature Conservancy, amphibian populations have taken a nosedive in each one over the last two decades.

"Gopher frogs have apparently now disappeared from all of them, and ornate chorus frogs from most," said Beane. "The same is true for a lot of other rare species of plants and animals that were relatively common there in the early 1980s."

When asked about the reasons for such declines, Beane said, "Those (bays) that remain in the landscape have suffered

The recently hatched larvae of North Carolina's most endangered frog, the gopher frog, swarm over the remains of an egg mass beneath the waters of a small wetland in Sandhills Game Land.



▲ Above, left to right: Snapping turtles, carnivorous yellow bladderworts and the eggs of gopher frogs can be found in seasonal wetlands near the author's hometown in the Sandhills. Below: Longleaf pines tower over the broad leaves of water lilies in a shallow pool at Sandhills Game Land.

from fire suppression, a lowering of the water table due to irrigation and wells dug for residential development, as well as prolonged droughts. A lack of forested buffer surrounding the bays, necessary for the life cycle of many of the threatened species when not breeding in the bays, has also contributed to the population declines."

Native Lakes

Natural lakes are a bit of an anomaly. Unlike man-made reservoirs, such as Jordan Lake near Raleigh or Lake James in the Mountains, no one really knows how the nearly 20 natural lakes scattered throughout our state's Coastal Plain were formed, though many theories abound. Some suggest their origins lie in a great, prehistoric meteor shower that rained down across much of the East Coast. Others think huge, prolonged wildfires burned deep into the peat layer, so prevalent in our Coastal Plain, creating oval basins that later filled with rainwater. Of more certainty is the fact that the natural lakes that dot our coastal landscape have sustained both wildlife and humans for thousands of years.

Take, for example, our state's second largest natural lake, the 16,600-acre Lake Phelps located on the Albemarle Peninsula. Over 30 early Native American dugout canoes have been found preserved in its waters, some dating 4,600 years in age. No doubt, the people who made them took advantage of the bounty of fish that call the lake home, including largemouth bass, bluegill, yellow perch and pumpkinseed sunfish.

Further south, near the South Carolina state line, lies Lake Waccamaw, one of the most biologically important lakes in North America. The majority of our natural lakes have highly acidic waters that are very low in nutrients, which in turn support few species of fish and aquatic insects. Not so at Lake Waccamaw. Limestone bluffs along part of its shore and sandy bottoms full of calcium keep its waters at a neutral pH level allowing life to proliferate.

Step into its shallow waters and you will find its sandy bottoms packed with

Freshwater mussels carpet the shallow, sandy bottoms of Lake Waccamaw. The calcium-rich waters of this natural lake, located in Columbus County, are home to numerous species found nowhere else on earth.

freshwater mussels. These homely mollusks thrive in the calcium-rich waters of the lake, using the mineral to strengthen and grow their shells. "We have recorded eight species of mussels from Lake Waccamaw over the past 10 years," said Brena Jones, an aquatic biologist with the Commission.

The lake is renowned for its high levels of endemism, with three species of fish, two species of snails and two mussels found nowhere else on earth. However, recent genetic work by Art Bogan of the Museum of Natural Sciences has shown that the two species of mussels formerly considered endemic to the lake, the Waccamaw spike and Waccamaw fatmucket, are actually just lake forms of two more widely distributed species. "Given the level of imperilment of all our native mussel species, I still consider the lake forms an important component of genetic diversity," Jones said.

Natural lakes across our Coastal Plain face a number of challenges. Over the last 300 years, many have been drained or ditched in attempts to make farmland more available. North Carolina's largest natural lake, Lake Mattamuskeet, was drained at least three times between 1916 and 1926, the last time leaving the lakebed dry for five years. White Lake, a 1,000-acre body of water tucked away among the longleaf pines of Bladen County, was once renowned for its crystal clear waters, but nutrient runoff from residential development and digging of wells along the shoreline have caused a significant rise in pH levels resulting in harmful algae blooms that cloud the water and kill fish.

Invasive species create additional strains on the flora and fauna of natural lakes. An aquatic weed native to Asia, hydrilla, has recently been reported from Lake Waccamaw. Considered the "world's worst invasive aquatic plant," hydrilla completely takes over a body of water, crowding out all native aquatic plants, altering water chemistry, increasing water temperatures and affecting the diversity and abundance of fish populations. Thick mats of the noxious weed can also impede recreational boating as well as limit fishing and swimming opportunities.

Home Waters

This past spring I returned to the seasonal wetland behind my parents' house. It had been a wet winter with lots of rain and a couple of large snowstorms and I figured the pool would be holding water. Despite the fact that the peepers were not calling this day, I was still able to find the small wetland nestled among the pines.

I instantly noticed the baseball-shaped jelly masses I first observed years ago scattered among the reeds in the shallow clear waters. Most of the eggs in them had long since hatched; seems I was a little late to the party this year.

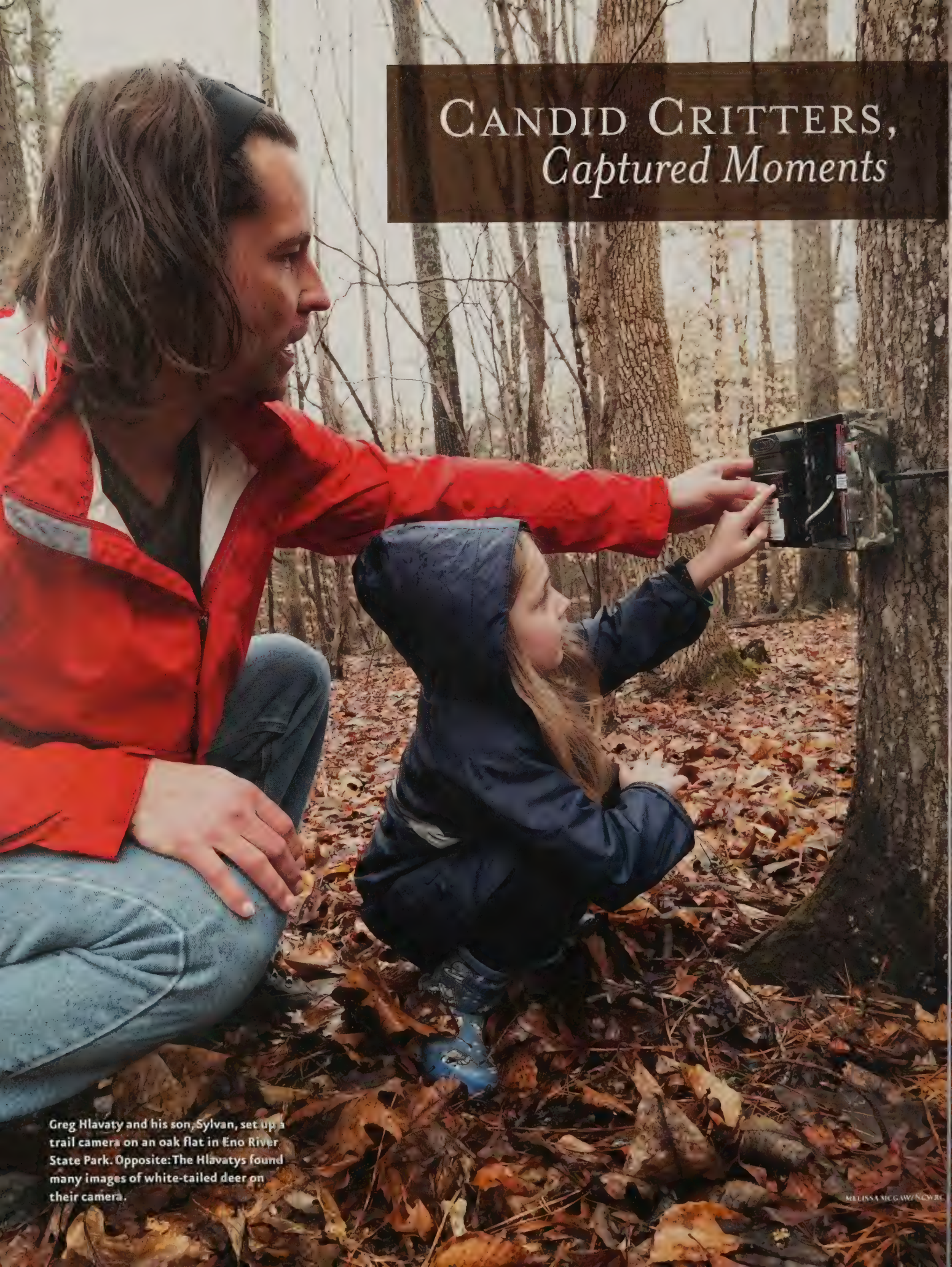
Kneeling down along the water's edge, I could see spotted salamander larvae swimming among the leaf litter at the bottom of the pool, their gills gently swaying back and forth. Soon, this wetland will dry up with the heat of summer and the salamanders will transform, like frogs, from their larval stage to adult form and make a journey into the surrounding forest where they will bury themselves underground and wait patiently for next winter's rains.

Smiling, I wished them luck.

Todd Pusser is a marine biologist and freelance writer whose articles and photos often appear in Wildlife in North Carolina.

▲ ▼ **The nearly 20 natural lakes found in the Coastal Plain are home to many species of fish, including such popular gamefish as the bluegill (adult below, juveniles above) seen here in Lake Waccamaw.**

Candid Critters, *Captured Moments*



Greg Hlavaty and his son, Sylvan, set up a trail camera on an oak flat in Eno River State Park. Opposite: The Hlavatys found many images of white-tailed deer on their camera.

MELISSA MCGAW/NCWRC

How one family bonded while participating in the citizen-science camera-trap program

Written by Greg Hlavaty

My family used to keep chickens. Four of them for company and eggs, not for butchering. They were part of the family, and any day spent in the yard meant letting the girls out to peck and scratch.

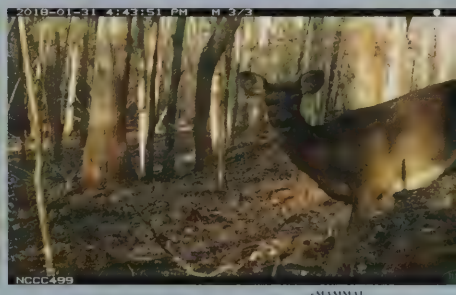
The change happened when my son Rowan was 5. We were eating chicken for dinner when he offered the following observation: "Isn't it strange that this meat is called chicken and we have chickens in our yard?"

He was smiling, pleased at his observation, and I looked at my wife. We had both known this moment was coming, so I had to tell him that the meat on his plate was the body of the type of bird we raised. Not one of our chickens, but still.

Rowan's eyes widened and he drew back from the table like a rattlesnake curled on his plate.

He has never eaten meat again, though the rest of us do. If asked, he'll still say "meat is delicious, I just don't want to hurt animals." He prefers his animals living, and nothing pleases him more than to see an animal doing what it's meant to do: a deer raising its head as we get too close, a chickadee clinging to the maple branch. He's always settled for what his eye could see, so when he found out that a trail cam can really show you the secret lives of animals, he immediately wanted one.

I said no. We're not hunters, after all.



American black bear, Eastern wild turkey and bobcat are but a few of the species to show up on trail cameras set up for the Candid Critters citizen-science program.

This past fall, we were wandering the woods behind our house in Graham and found some scat that puzzled us. We checked it against our field guide but nothing matched, and I'd joked that maybe a bear was wandering our woods. From that comment, Rowan, now 9 years old, became convinced that there was a bear and said we should get a trail cam to find out.

Enter Candid Critters, a citizen science program that is a collaboration among the N.C. Wildlife Resources Commission, N.C. State University, N.C. Museum of Natural Sciences, the State Library of North Carolina, N.C. Cardinal, the Public Libraries of North Carolina and the Smithsonian. Public libraries provide the trail cameras, and North Carolina residents seasonally place the cameras at assigned locations, and then analyze and upload the results. An effort to engage the community in helping wildlife conservation and management, Candid Critters is citizen science at its best: free, fairly easy to engage, kid-friendly, and with clear instructions for the inexperienced.

Since it launched in December 2016, roughly 1,200 volunteers have deployed more than 2,000 cameras on public and private lands across the state. More than 1 million photos have been uploaded to the Candid Critters database, capturing photos and locations of various animals, including deer, bear, turkey, fox, bobcat, coyote and more. To see photos captured during the project, visit nccandidcritters.org.

"Camera traps are like binoculars for mammal watchers, they let you get a close-up view of critters you normally only know about from footprints or fleeting glances as they run away from you," said Roland Kays, the project leader and head of the Biodiversity Research Lab at the Museum of Natural Sciences.

Now, we didn't know much about camera traps. Luckily, Candid Critters offers a complete online training program. We chose our own property for the first camera trap, and my wife Jenn and 4-year-old son Sylvan also joined us. How quickly a simple errand like setting a trail cam became a quest for the perfect spot, and it freshened our eyes to look at our landscape through the eyes of a wildlife conservationist. Where's a tree thick enough? Where's the flat ground? What's likely to get animals behaving naturally?

Like the best education, setting up the camera provided a chance to teach skills in context, so both Rowan and Sylvan learned how to use a GPS, read a tape measure and perform a walk test. As we were leaving the woods that day, Rowan said, "If we get our pictures back, we're going to be like 'Oh snap, that's a bear!' Yeah? Is that how it is?"

When I'd checked out a camera, I'll admit I was thinking science, but Rowan was obviously still thinking bear. "Who knows?" I said, laughing. "It's not likely, but maybe."

Though we were supposed to leave the camera in place for three weeks, I got antsy after four days and opened the camera; 400 shots already? Was that possible? I wanted to pull the card, check it, and start over.

Rowan disagreed.

"Let's just make sure the camera's working," I said, even though I could see it was working. I just wanted to see what we had gotten. The mystery, I think, was the hook. We have 400 shots of something. Why couldn't we just take a peek?

"No," Rowan said. "I think we're supposed to wait three weeks."

Part of me wanted to tell him that maybe we had gotten a shot of a bear, but I didn't really believe it, plus Rowan had that stubborn look like when he drew back from the chicken.

So, like good scientists, we waited.

Three weeks yielded over a thousand pictures, almost entirely of white-tailed deer. We had seen plenty of deer on our property, but these pictures made it look like they had nightly parties while we slept. As if to prove the curiosity of deer, nearly every series included one of them nosing up to the camera, a full face shot as if the deer wanted a portrait.

Since having a purpose encourages learning, I taught Rowan how to use the software and he enjoyed scrolling through the results: plenty of doe, two bucks (one an 8-pointer), raccoons and squirrels. Without my nagging, he helped me count and identify the sex of each species and then enter the data in the form. He almost forgot he had hoped for a bear.

At one point, we scrolled through a series of a doe running, and my wife pointed at the screen. "Wait, is that her breath?"

We cycled back and reviewed the series. On a cold January day, the doe had run in

eMAMMAL

and paused right before the camera. In a series of five shots, her side pulsed and her breath visibly formed in the air. A few frames and then she was gone, running again to somewhere we could not see. That is the magic of Candid Critters: You set the camera without expectation and enjoy what the animals give.

While my wife and I loved the photos of the deer breathing, it was a dog, of all things, that fascinated our youngest son, Sylvan. I was scrolling through a four-shot series of a random pit bull running at full speed across the frame, and Sylvan edged in front of me and took the mouse.

"What!" Sylvan said. "A dog?" While laughing, he ran it back to watch it run. Again. And again.

Looking at my wife, I shrugged. It wasn't what I expected, but stepping back to watch the boys laugh at this dog running, tongue lolling, made me think: It wasn't what I had expected, but it is enough.

Candid Critters requires moving the camera every three weeks, and our next pre-approved spot was Eno River State Park. Feeling like professionals now, we cut from the trail, found a flat spot, locked the camera around the tree and performed our walk test. Simple enough. Then we left, enjoyed a hike, and went home.

I was feeling like a real scientist, a data-collecting pro, until I remembered the key. I patted my pockets, checked the camera box.

"Where's the key?" I asked.

"What key?" Jenn said.

"The one that locks the camera to the tree."

The embarrassing truth: I'd left the key in the camera lock. Sure, it was off-trail, so it was unlikely someone would steal it, but it wasn't impossible. I spent a couple days worrying I'd lost their camera, berating myself for such a careless move, until the next weekend when we made it back to Eno River State Park.

I felt stupid and angry with myself, so not like a real scientist. Luckily, the key was still there, and after retrieving it, Rowan and Sylvan went to the river to shoot their new slingshots. My wife pointed out targets and the boys fired hickory nuts and small stones. They seldom hit the target, but the simple act of aiming showed us the water's movement, and scouring the ground for slingshot ammo alerted us to deer tracks and signs of squirrel. As others hurried by us, we lingered at water's edge, and I began to relax, the anger at my losing the key fading.

"...what you find is less important than the fact that you're out in the field looking for...well, whatever happens."

Watching the river break around a rock, I thought that maybe the best part about Candid Critters, or any citizen science program, was moments like this one, where what you find is less important than the fact that you're out in the field looking for... well, whatever happens.

Farther down the trail, I noticed a large downed oak, its curved trunk forming an arched bridge above the forest floor. "You guys want to balance on that tree?" I yelled behind me, just as I cut a hard right into the woods.

I climbed up and walked the oak's length, and before long I heard feet crushing leaves, and Rowan was behind me, balancing on the tree. Then I circled around and Jenn took a turn while I held Sylvan's hand, steadying him on the difficult parts.

More people came. A father and son, and later two women, crossed the tree. None of us knew each other, but we all had in common an unplanned moment of slowing down and experiencing the landscape.

After log balancing, Sylvan said, "I'm a Jedi." So, I told him that this was Jedi training.

I used a stout branch to pole vault over a dried creek, and for Rowan's turn, I stood in the creek bed and held the branch, pushing it as Rowan clung to the top. He sailed across while his little brother ran screaming down the creek bed, ducking under a log that later became another balance beam.

How long Jedi training lasted I don't know. But it was the best day we had ever spent at Eno River, and it only happened because I lost something, and then went back into the field to find it.

Greg Hlavaty is a freelance writer and novelist based in Graham. He has taught survival skills classes and led outdoor trips in North Carolina and Alaska. This is his first article for Wildlife in North Carolina. *For more information on Hlavaty and his writing, visit greghlavaty.com.*

Shining a Spotlight on Spotted Skunks

COMMISSION BIOLOGISTS LEAD A LONG-TERM STUDY OF THIS ELUSIVE AND ENDANGERED SPECIES

Written by
Dan DeWitt

NEIL PEARSON

IN three hours of checking game cameras in the western North Carolina mountains, N.C. Wildlife Resources Commission biologists Casey Dukes and Colleen Olfenbuttel had reviewed images of mice, squirrels, a coyote and several old frames of a hoodie-clad Dukes approaching cameras to remove them from their mounts.

Now Olfenbuttel called out the list of subjects photographed at the morning's last site, in a forest overlooking the muddy expanse of an empty reservoir near Murphy.

"We have pig and deer," she said, clicking through the frames. "And a person."

That the cameras had failed to photograph the biologists' target species, the Eastern spotted skunk, was really no surprise. Four years ago, the Commission embarked on this long-term study of the spotted skunk precisely because of the qualities that make it hard to capture on film: Its population has mysteriously plunged since World War II and it has long proven to be an elusive subject. Before a big bump in the number of spotted skunk images the researchers captured this year during this study, the grand total had stood at an even dozen from 2014 through 2017.

"It's a very cryptic species," Olfenbuttel said. "The knowledge gap is huge."

That is true among members of the public, most of whom picture skunks only as the larger, more common striped variety. "I've rarely talked to anybody who was even aware we have a second skunk species in North Carolina," said Olfenbuttel, the Commission's black bear and furbearer biologist.

The knowledge gap also extends throughout the range of the Eastern spotted skunk, which includes the Great Plains, the Appalachian Mountains and Florida. Awareness of just how little was known about the skunks—commonly known as "spotteds"—began to spread around 2011, when state furbearer biologists in the Southeast started talking about the lack of observations and detections of the skunk at their annual meeting. Over the next few years, states began updating their wildlife action plans (WAP) needed to qualify for federal funding, which included gathering subject-matter expertise from state biologists and researchers.

In North Carolina, the updated 2015 WAP identified that the Eastern spotted skunk lacked information on distribution, abundance, and factors affecting its population size, making it a priority species for surveys, monitoring and research. In addition, a golden eagle survey across the Appalachian states started capturing incidental spotteds on camera. All of this led to such a surge of interest in spotteds that Olfenbuttel was inspired to help found the Eastern Spotted Skunk Cooperative Study Group in 2015, which allows researchers and state biologists to share methods and findings.

Her action, along with the comprehensive research project the state is conducting with Clemson University, has put North Carolina "kind of at the epicenter of the groundswell," Olfenbuttel said.

A STEADY DECLINE. Spotteds' disappearance from our landscape and consciousness is all the more striking because they used to be so prominent in both. Common skunk nicknames such as civet cat and polecat refer not to stripeds, but to spotteds. And in the 1940s, trappers across the country typically harvested tens of thousands of spotted-skunk pelts a year, Olfenbuttel said.

By the late 1950s, she said, "that number was literally down in the hundreds." Most of the scanty available evidence points to continued decline. A 2017 sighting of a spotted skunk in South Carolina, for example, was the first in the state in 16 years, said David Jachowski, an assistant professor of wildlife ecology at Clemson and the chairman of the cooperative study group.

Researchers have identified several possible causes of the range-wide population decline that started in the 1940s: diseases; industrial agricultural operations that displaced the bushrows and other natural areas common on smaller farms; widespread use of pesticides that reduced prey availability; and unregulated overharvest of the spotteds' distinctive pelts. Current factors that could be suppressing populations include diseases, such as rabies or canine distemper, growing or spreading populations

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These two photos of Eastern spotted skunks were taken with the use of trail cameras, or camera traps. Spotted skunk populations are low in western North Carolina with several factors contributing to their decline.

MISSOURI DEPARTMENT OF CONSERVATION

JOHN MACGREGOR

WEST VIRGINIA DEPARTMENT OF NATURAL RESOURCES

A baited camera site in the Appalachian Mountains captured an Eastern spotted skunk threatening to spray a bobcat. Spotteds do a handstand on their two front legs and can move toward a threat, directing their anal glands at the perceived danger.

of aerial and terrestrial predators such as owls and coyotes; loss of early and mid-successional forests, which provide dense woody cover and forage; increased habitat fragmentation, resulting in isolated populations; and encroaching development on a creature that may be less adaptable to human presence than its striped sister species.

Which one is likely the main culprit?

"We don't know," Olfenbuttel said, a response she repeated to a whole series of questions during the camera-checking expedition near Murphy in February.

Were spotteds always confined to their current range in the North Carolina mountains or did they once roam the entire state? Does the species prefer high elevations or is that just the location of the dense understory that is its preferred habitat? Is the low number of sightings due mostly to the skunks' secretive nature, or are they rare enough to justify protective status as Threatened or Endangered?

Scientists not only lack this information, she said, but also reliable data on "basic life history traits," such as mortality, denning preferences and dispersal rates.

NOT YOUR AVERAGE SKUNK. Olfenbuttel does know enough to believe that, with broader awareness, the public would embrace the species. Spotted skunks are reluctant to release their spray, which requires about a week to replenish, and therefore give elaborate warnings beforehand; they not only stomp their rear feet but raise their hindquarters in a handstand, sometimes peering over a shoulder to gauge the reaction of potential threats.

Spotteds are smaller than striped skunks, about the size of fox squirrels, with facial features suited for a stuffed toy—button noses, small ears, round eyes and foreheads marked by an inverted triangle of white fur. "Cute is a word a lot of people use to describe them," Olfenbuttel said. And when she displays pelts during public presentations, she said, "people really zero in on the spotted skunks." Their coats are marked not so much by spots as by networks of meandering stripes, and are finer and thicker than the notably coarse fur of the striped skunk.

"This is not a very scientific term," Olfenbuttel said, "but they're fluffier."

Scientists also know enough about spotteds to develop research strategies. Spotteds, which produce litters of between one and five young in the spring, are most active—and most likely to be captured on film and in traps—during their late-winter and early-spring breeding season. And though they are primarily insectivores, they will consume almost any available food, from berries to carrion, meaning they can be attracted by a wide variety of lures.

This was proven in a long-running study of golden eagles in the Appalachians, during which cameras photographed several spotteds raiding the caches of fresh roadkill used as bait. These unexpected cameos not only confirmed the feasibility of a camera study for spotteds but helped spark the current wave of interest in studying them.

"That was good encouragement to rediscover a species that had largely been forgotten," said Jachowski.

He developed the camera protocol while working as a post-doctoral researcher at Virginia Tech. At Clemson, he supervises the undergraduate students who analyze the photographs: a master's candidate, Robin Eng, who has built her thesis around a camera study that includes North Carolina, and a Ph.D student, James Hody, who will continue to use the camera study, as well as capture and track skunks in North Carolina.

Dukes, the Commission's surveys and research biologist, is the staff biologist responsible for coordinating the camera study. Earlier this year, she and staff from the Commission's Land and Water Access program, along with several cooperating agencies, set up 51 camera sites at elevations ranging from about 1,000 to 4,000 feet. The bait employed is sardines, a can of which—accompanied by a long-handled hammer—rattled around in the blue plastic Lowe's bucket Dukes carried to each site near Murphy.

While Olfenbuttel talked about the species and the study, Dukes pried the old cans from their tree trunks. She secured each new

Spot the Difference

Did you know that two species of skunks can be found in North Carolina? While most people are familiar with the common striped skunk, the endangered Eastern spotted skunk is not only more difficult to find, but it is also smaller and fluffier than its fellow skunk. Here are a few tips on how to identify each species of skunk.

Eastern Spotted Skunk

1. Upside-down triangle on forehead and narrow white stripe beneath the eye.

2. Two stripes run diagonally across each hip; a few white spots on the rear end.

3. Bushy tail is white underneath and at the tip.

Striped Skunk

1. Narrow white stripe down the center of the face.

2. Usually two white stripes down the back.

3. Long fluffy black tail.

To learn more or to report observations please visit ncwildlife.org/spottedskunk.

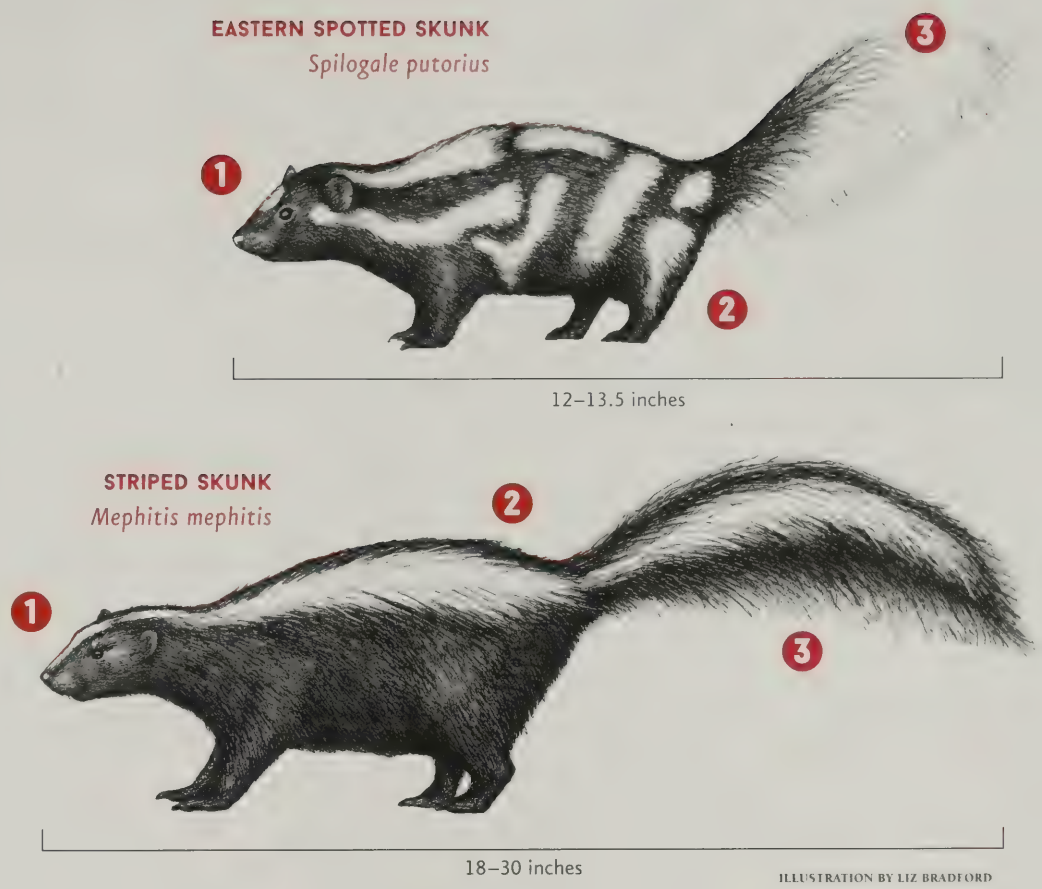


ILLUSTRATION BY LIZ BRADFORD

can with three large nails that she worked back and forth to widen the nail holes, allowing the oil to flow and the smell to spread. She then unlocked the cable that secures each metal camera case to a tree trunk opposite the bait, then released the padlock that keeps the case closed.

Thanks to these measures, no camera in the previous three years of the study had been damaged by either curious bears or thieving humans, she said. "To get to one of these cameras you'd pretty much have to cut down the tree." And though the main reason for checking cameras is to ensure that adequate space remains on their digital cards, she and Olfenbuttel couldn't resist taking a peek at the recorded images. "If you're a biologist and you don't like looking at game pictures, you need to get a different job," Dukes said.

CAMERA-SHY CRITTERS. In the first two years of the study, the scans of these frames almost always ended in disappointment.

> "CUTE IS A WORD A LOT OF PEOPLE USE TO DESCRIBE THEM...THEIR COATS ARE MARKED NOT SO MUCH BY SPOTS AS BY NETWORKS OF MEANDERING STRIPES"

The cameras netted one picture of a skunk in 2015 and two images the following year. The brand of the first batch of 50 cameras—purchased by Olfenbuttel with revenue from a federal firearms and ammunition tax (the Pittman-Robertson Act)—was partly to blame. In 2017, after replacing the cameras with a cheaper but more sensitive model, researchers photographed spotteds nine times.

That number jumped to 45 this year, a breakthrough that might be due to researchers' use of two cameras at some sites, or to the decision to cut out additional scents that had previously been used along with the sardines. But until researchers can study the results more thoroughly, the reasons for "the improvement in detections is mostly theoretical for now," Olfenbuttel wrote in an email.

"What we do know, is that with the progression of this research and using the right tools and technology to improve data collection, our detections—so far—have continued to increase."

The most telling data will come in the second phase of the study, conducted by Hody, the Clemson doctoral candidate, who has trapped a total of 15 skunks near Morganton. Once he captures skunks, he weighs them, measures their height and length, takes blood and hair samples, and attaches tiny radio collars.

The samples allow him to study the species' genetic makeup and search for diseases. The collars allow him to track the animals as they dig burrows and mate and raise young. Once Hody's work is complete, in about five years, researchers will have a far clearer picture of the threats to spotteds and their population status. The knowledge gap should close considerably, and scientists expect to face far fewer questions they cannot answer.

"North Carolina is right there with the other [states'] studies and has stepped up the bar," Jachowski said. "The level of information we learn about the species should be pretty much unprecedented."

Dan DeWitt is a former newspaper reporter and columnist in Florida who recently relocated to North Carolina. This is his first article for Wildlife in North Carolina.

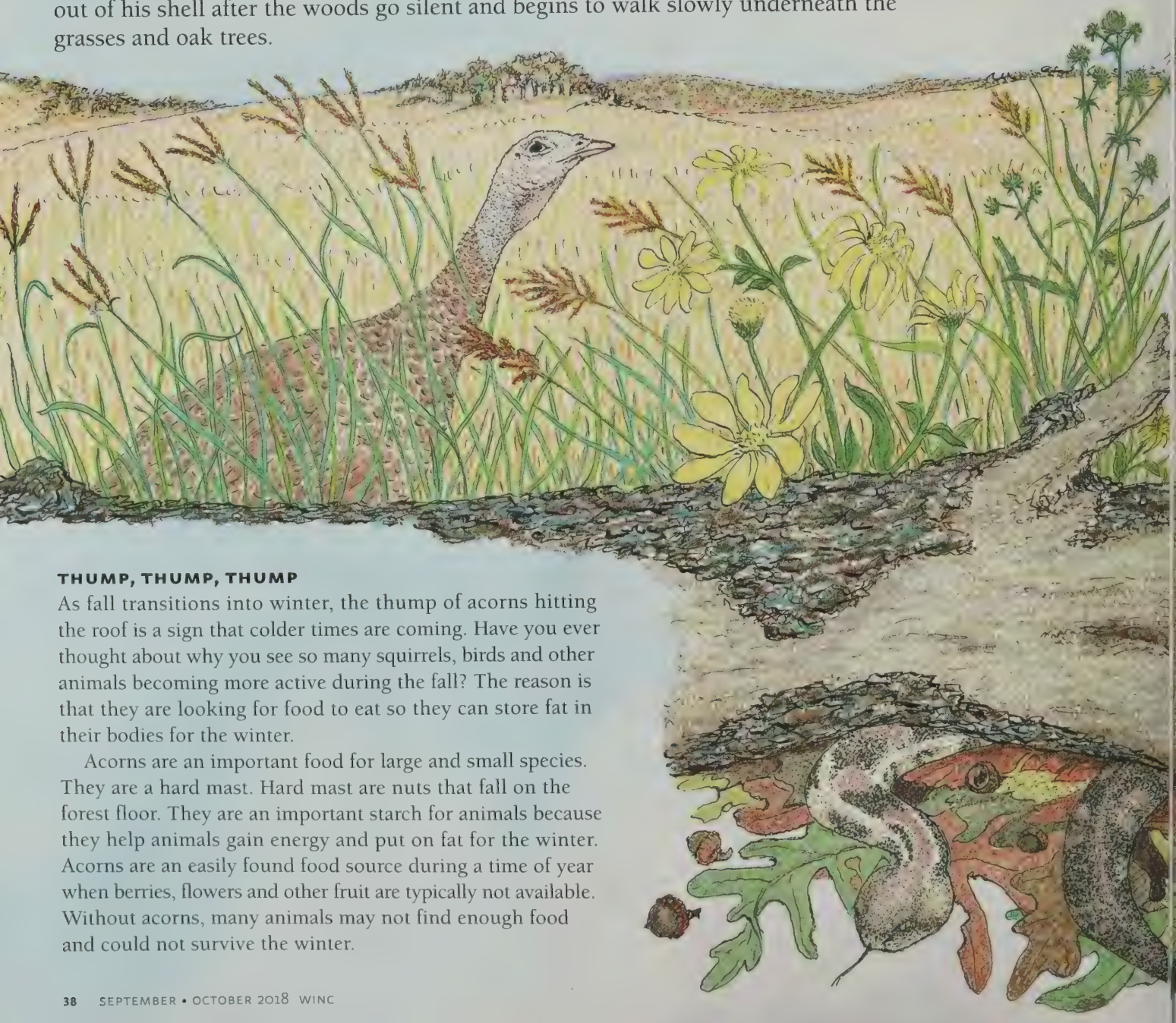
This habitat is becoming harder and harder to find in North Carolina, but animals big and small still seek it out for food and shelter.

Home in an Oak Savanna

written by Sydney Brown
illustrated by Anne M. Runyon

Leaves crunch as the timber rattlesnake's body grips and releases. A deer and its fawns crunch lazily at acorns they lip off the ground. A turkey jumps, taking flight and causing the deer to bolt through the woods, twigs snapping and leaves crinkling under the pounding of their hooves. They race by, startling blue-winged and golden-winged warblers from their tree branches. A box turtle pokes his head out of his shell after the woods go silent and begins to walk slowly underneath the grasses and oak trees.

TURKEY FOOT, INDIAN GRASS, SMALL WOOD SUNFLOWER AND RATTLESNAKE MASTER



THUMP, THUMP, THUMP

As fall transitions into winter, the thump of acorns hitting the roof is a sign that colder times are coming. Have you ever thought about why you see so many squirrels, birds and other animals becoming more active during the fall? The reason is that they are looking for food to eat so they can store fat in their bodies for the winter.

Acorns are an important food for large and small species. They are a hard mast. Hard mast are nuts that fall on the forest floor. They are an important starch for animals because they help animals gain energy and put on fat for the winter. Acorns are an easily found food source during a time of year when berries, flowers and other fruit are typically not available. Without acorns, many animals may not find enough food and could not survive the winter.

WHITE OAK LEAF/ACORN

SAVANNA IN THE SOUTHEAST

As the rolling hills of the Piedmont turn into the Blue Ridge Mountains, tall pines start to mix with more oaks to create dense forests. It wasn't always this way. Hundreds of years ago, large herbivores (animals that eat plants) roamed the mountains of North Carolina, where there were fewer trees and large areas of grasslands. Bison and elk grazed in habitat referred to as oak or chestnut savannas.

There are not as many savannas today and they must now be managed by human hands. Bison no longer roam and help disturb plants. Passenger pigeons, which used to rest in the limbs of chestnuts and oaks and eat acorns by the thousands, are extinct. And a disease called "chestnut blight" has destroyed millions of chestnut trees.

All that's left are a few oak savannas mixed in with some pines. How can you tell an oak savanna from a meadow? Oak savannas are complex habitats with tall grasses and oaks spread across a large landscape. Savannas must be disturbed, or changed, every year by ice storms and small fires. Humans typically use fire to preserve savannas, whose grasses provide great cover animals. Turkeys love this type of habitat for finding food and roosting (or resting) in trees.

HOW TO PROTECT SAVANNAS

Without oak trees and tall grasses, many animals would be without two of the most important things they need to survive: food and shelter. Savannas require large areas of land. One of the best ways to protect these areas is to visit one yourself and see the many different animals that rely on this habitat.

OAK-LOVING COLLYBIA

Get Outside

South Mountain, Black Bear tract of Pisgah, Sandy Mush, Johns River and Needmore game lands are all great areas to see oak savannas. Most of these spots also have pine savannas. Be on the lookout to see how large these areas are and the space they require, and if you can, close your eyes and imagine why hundreds of large animals were able to make a home in our savannas.

A TASTY TREAT: WHITE OAK ACORNS ARE GREAT INGREDIENTS FOR COOKING

Settlers and Native Americans used acorns as an important food source hundreds of years ago. Many people who forage, or look for food in the wild, still eat them. Acorns drop every fall and need to be gathered quickly before other animals get to them.

The white acorn is probably the tastiest of the acorns. Tannins are what causes an acorn to taste bitter and the white oak has one of the lowest levels of tannins. Before you can cook with acorns, you must first collect them and prepare them for processing.

IMPORTANT: BEFORE YOU START THIS RECIPE, PLEASE ASK PERMISSION FROM AN ADULT AND GET THEM INVOLVED, TOO.

STEP 1: To figure out which acorn belongs to the white oak, you must know what the tree looks like. The white oak leaf is lobed, meaning that it is divided into different parts. Each white oak leaf has five to nine lobes per leaf, and has notches cut equally between each lobe. The acorn cap of the white oak covers the upper-third of the nut. You need to gather several handfuls of acorns to get what you need to make a recipe. Check for holes, this is a sign that larvae of oak weevils are growing inside the acorn. You don't want to eat maggots, do you?

STEP 2: The quicker you process your acorns after gathering them the better. With help from an adult, bring a large pot of water to boil and place acorns (shell and all) into the pot. Make sure to only put the acorns in after the pot is boiling because cold water can lock in those bitter tannins that can upset your stomach. Boil for a couple of minutes and then strain, allowing acorns to cool.

STEP 3: Now comes the fun part! It's time to crack those nuts. You can do this using a nut cracker or a small log and a cutting board. Crack open the shell and peel it away by hand, place the kernel in a bowl and keep cracking until you're done.

STEP 4: Bring two large pots of water to boil. Place the kernels inside one pot and boil until the water turns dark, about 5 minutes. Strain and then add them again to the second pot behind it. This process of leaching the acorns makes them tastier. Keep repeating this process until you are satisfied with the taste.

STEP 5: Do something with your acorns. People chop them up to use on salads, grind them to make flour or add them to a delicious dinner. You can freeze them, dry them, roast them —they are good on just about anything.

Commission Welcomes New Law Enforcement Officers

Twenty-one cadets were sworn in as wildlife law enforcement officers by the N.C. Wildlife Resources Commission at a graduation ceremony held at Campbell University in early July. During the ceremony, which celebrated the Commission's 55th Basic School graduation, each cadet took an oath to enforce criminal laws, including conservation and boating laws, and to faithfully and impartially execute the duties of a law enforcement officer in North Carolina.

Each new wildlife officer will now begin six months of on-the-job training under the supervision of a veteran wildlife officer. Upon completion of field training, each officer will be assigned a permanent duty station.

The graduating officers are listed below, along with their county of assignment:

- Kyle Barkley of Putnam, Tenn.
  Chatham County
- William Boone of McDowell County
  Cleveland County
- Christopher Brittian of Buncombe County
  Jackson County
- Cole Cantrell of Caldwell County
  Anson County
- John Chavis of Robeson County
  Bladen County
- Aaron Cronk of Ashe County
  Stokes County
- Dakota Curtis of Sumter, S.C.
  Swain County
- John Dooley of Saranac Lake, N.Y.
  Wilkes County
- Jeffrey Doran of Deep River, Conn.
  Currituck County
- Hunter Everhart of Wake County
  Martin County
- Elisabeth Frasch of Wake County
  Chowan County

MELISSA McGAW/NCWRC

Twenty-one new law enforcement officers were sworn in during a July graduation ceremony.

- Jared Garland of Yancey County
  Rockingham County
- Alexander Holbrook of Pender County
  New Hanover County
- Jonathan Hornbeck of Pitt County
  Cumberland County
- Jacob Long of Columbus County
  Franklin County
- Edward Perdue of Union County
  Sampson County
- Nathaniel Rowlan of Loveland, Colo.
  Lenoir County
- William Shepherd of Wilkes County
  Iredell County
- Jenrette Springs of Guilford County
  Wake County
- Allen Vang of Iredell County
  Mecklenburg County
- Rose Williams of Horry, S.C.
  Catawba County

"Today's graduation celebrates the accomplishment of these newly-sworn officers successfully completing 27 weeks of intensive training," Col. Jon Evans said.

All wildlife law enforcement officer trainees are required to pass an extensive background, psychological and physical screening before entering an intensive accredited academy conducted by the Law Enforcement Division. Most of the training is held at the N.C. Justice Academy in Salemburg. Officers complete conservation-specific training on fish and wildlife laws, motorboat accident investigation and protected species. Instruction covers statutory and investigation procedures, defensive tactics, fish and game laws, and pursuit driving and boating.

The Commission is accepting applications for Wildlife Law Enforcement Officers for next year's class. Visit governmentjobs.com for more information.

e NEWSLETTER

Get N.C. Wildlife Update—news including season dates, bag limits, legislative updates and more—delivered to your Inbox from the N.C. Wildlife Resources Commission. Sign up at ncwildlife.org/enews.

Hickory Student Aims for Greatness

A fourth-grader from Ray Childers Elementary School in Hickory is the first student from North Carolina to win top honors at the recent National Archery in Schools Program (NASP) Tournament and the Centershot Ministries National Tournament held in Louisville, Ky.

CHARLIE BAGLAN

Natalie Bell earned the title of National Champion in the Elementary Girls Division at the 2018 NASP tournament, scoring 293 out of 300 potential points. She was also crowned National Champion in the Elementary Girls and Elementary Boys Division at the 2018 Centershot Ministries tournament, scoring 291 out of 300 possible points. Additionally, Bell earned member status in the Elementary Division of the 2018 NASP All-American Academic Archery Team.

Natalie is the daughter of Clint Bell, a master officer with the N.C. Wildlife Resources Commission's Law Enforcement Division. She began participating in archery events as a third grader.

"We are so grateful for the N.C. Wildlife Resources Commission, Lee Scripture, Coach Michael Steele and Burke County Public Schools for their dedication to growing the NASP program," Officer Bell said. "Without the partnerships between these people, the Ray Childers Elementary School archery team and our daughter would not have had the opportunities to compete in such an awesome program. Watching the team win the state championship and our daughter become a national champion were very special moments for us."

Natalie competed in the Elementary Girls Divisions at the 2018 NASP World Tournament and the 2018 Centershot Ministries World Tournament. She finished in second place out of 616 participants in the NASP Tournament and took fifth place in the World Tournament.

"It feels good to work hard, practice and listen to my coaches then see the good results that my team and I have gotten," Natalie said.

NASP teaches and promotes international-style target archery as part of an in-school curriculum to improve educational performance and participation in the shooting sports among students in grades 4–12. For more information, or to find out how your school can participate, visit naspschools.org.

"The North Carolina program is growing each year largely due to our young scholar-athletes like Natalie Bell," said Lee Scripture, the Commission's archery education coordinator.

Commission to Feature Wetlands Display at N.C. State Fair

When you're enjoying the State Fair in Raleigh this fall, be sure to visit the Commission's exhibit between the Children's Barnyard and the Old Farm Machinery Building. This year's theme centers around wetlands, including an American alligator on the state fair button.

The Commission's exhibit will feature simulated wetland habitats—including an alligator nest and a beaver lodge, profiles of wetlands species and explanations of the importance of wetlands. As always, the Commission's Wild Store will be on site with T-shirts and caps for sale and the pellet gun range will open for shooters of all ages to try. The range will be manned by Commission law enforcement and hunter education personnel to ensure safe use of the pellet rifles. Dates for the fair are Oct. 11–21.

Commission Unveils New Public Fishing Areas

The N.C. Wildlife Resources Commission partnered with Alleghany and Surry counties to provide anglers with two new public fishing areas on the New and Ararat rivers that opened in June.

Farmers Fish Camp Public Fishing Area (PFA), a partnership between the Commission and Alleghany County, provides access to the New River northwest of Sparta. The PFA has access stairs with a handrail and a slide for canoe, kayaks and other paddlecraft. GPS coordinates are 36.551317, -81.182612

The Commission previously had a public fishing area at the Farmers Fish Camp site that closed in 2013 after an adjacent bridge was destroyed by a flood.

The Commission constructed Farmers Fish Camp PFA using money from the Sport Fish Restoration Program, as well as fishing license sales receipts. Alleghany County will maintain the area.

On the Ararat River west of Pilot Mountain is the new Highway 268 East PFA, a partnership with Surry County, where Commission staff provided engineering and survey work using money from the Sport Fish Restoration Program, as well as fishing license sales receipts. Surry County paid to have the site built by a private contractor using funds provided by the Duke Energy Water Resources Fund. GPS coordinates for the PFA are 36.366652, -80.543216.

KIM HODGES

The new Highway 268 East Public Fishing Area is located west of Pilot Mountain.

The Ararat River PFA has a hand launch for paddlecraft. It can be used as a take-out point for anglers launching at formal, public accesses in Mt. Airy or as a put-in for anglers taking out at the Pilot Mountain State Park Shoals Access on the Yadkin River.

CALENDAR OF EVENTS

Saturday–Sunday, September 8–9

The 15th Annual Currituck Wildlife Festival will be held at Currituck High School in Barco. Wildlife artists, decoy carvers, decoy collectors and good food will be under one roof. This is a fundraiser for the Coinjock Ruritan Club. Visit coinjockruritanclub.com.

Saturday, September 22

Celebrate National Hunting and Fishing Day (NHFD) with the Commission at the Durham County Wildlife Club in Morrisville. The event will feature fishing in an 11-acre pond, archery, an air-rifle range, sporting dog demonstrations, treestand safety, camp site demonstration, reptile display and much more at the 96-acre facility. NHFD events will also be held at the Pisgah Center for Wildlife Education in Marion and the John E. Pechmann Fishing Education Center in Fayetteville. For more information, visit ncwildlife.org/NHFD.

October 27

Dismal Day is a fun-filled family festival celebrating history and nature at Dismal Swamp State Park in South Mills from 10 a.m. to 2 p.m. Contact: Adam Carver at dismal.swamp@ncparks.gov/.

Readers should check with the contact listed before traveling to an event. Items for listing should be conservation-oriented and should be submitted at least four months in advance to mike.zlotnicki@ncwildlife.org, or call 919-707-0175.

LIFETIME LICENSES

Help conserve wildlife for future generations. In 1981, hunters, anglers and wildlife enthusiasts became shareholders in an innovative investment and conservation program called the North Carolina Wildlife Endowment Fund.

Today, the commission has 19 different lifetime licenses in five categories: Infant, Youth, Adult, Senior and Disabled.

The endowment fund for wildlife was a simple yet revolutionary idea: Create a lifetime inland fishing or hunting license. Put the license fees into a special fund. Spend the accrued interest, not the principal, on programs and projects that benefit fish and wildlife. To learn more or to purchase a lifetime license visit ncwildlife.org/licensing or call 1-888-248-6834.

The Big Rock has Record Week

The 60th Annual Big Rock Blue Marlin Tournament had a wacky ending on June 16 when seven blue marlin were brought to the scales in a dash for part of the record $2.56 million purse.

When the spray settled, the three blue marlin atop the leaderboard were separated by 17.6 pounds. The difference between first and second place was just 4.2 pounds. The Honey Hush, captained by Chuck Linder of Morehead City, took first place with a 518.5-pound blue marlin and won $753,875. The fish was caught by Robert Gorrell on June 12.

The Fender Bender, captained by Carl Beale of Virginia Beach, weighed in a 514.3-pound fish to finish second and claim $262,450. The Carterican, captained by Lee Smith of Morehead City, brought a 500.9-pound blue marlin to the scales midway through the Saturday weigh-ins. The marlin, landed by Cole Ammons of Cedar Point, qualified—by less than a pound—for the Level V Fabulous Fishermen prize of $501,500, and won the third-place purse of $127,500.

Wallhanger, captained by Gary Blount of Greenville, won $200,457 for the most release points (1,325) during the tournament. Wallhanger captured a daily and the overall release category with three blue marlin and one white marlin release.

Shifting Gears, captained by Alan Scibal of Beaufort, finished second in the release division with 1,200 release points. Shifting Gears, owned by NASCAR legend Terry Labonte, released three blue marlin to earn $91,162.

PHOTO COURTESY OF THE BIG ROCK BLUE MARLIN TOURNAMENT

Left to right: Rob Warren, Ian Cader, Chuckie Lindner (kneeling), Chuck Lindner, Robert Gorrell, Jeffrey Albritton and Cully Cameron.

Shenandoah, captained by Alan Willis of Morehead City, won a daily release prize and finished third in the release division to earn $109,295. Crews from Coverage, Double B and Release all won $48,520 in the daily release competitions.

Goombay, captained by Brian Peele of Salter Path, won the winner-take-all dolphin division with a 71.1-pounder pulled in by Jeff Ross. Goombay won $146,200 plus $7,000 in daily and weekly prizes.

For complete tournament results, visit thebigrock.com. Since 1986, the Big Rock has donated over $4 million to charities and community projects.

Quail Forever Debuts New Chapter

On June 28, Quail Forever formed a new chapter in the Raleigh area, the Neuse River Chapter. Volunteers are focusing on habitat improvements and conservation education to create positive impacts for bobwhite quail and other wildlife. Chairman Wil Sterchi is leading the charge with a group of energetic volunteers. The chapter plans to host its first fundraising event this fall.

Quail populations in the Southeast have seen a consistent decline since the mid-1980s due to changing land-use practices, but success stories can still be highlighted throughout the region thanks to conservation advocates paving a new path for the Southeast's most iconic bird. The Neuse River Chapter of Quail Forever will utilize the organization's unique local approach to help fund projects and initiatives to help reestablish quail habitat and bobwhite hunting in North Carolina.

Quail Forever is a leading organization dedicated to upland habitat conservation efforts for the United States' native quail species.

To get involved with this chapter, contact Wil Sterchi at wsterchi@gmail.com.

How Do Flying Squirrels 'Fly?'

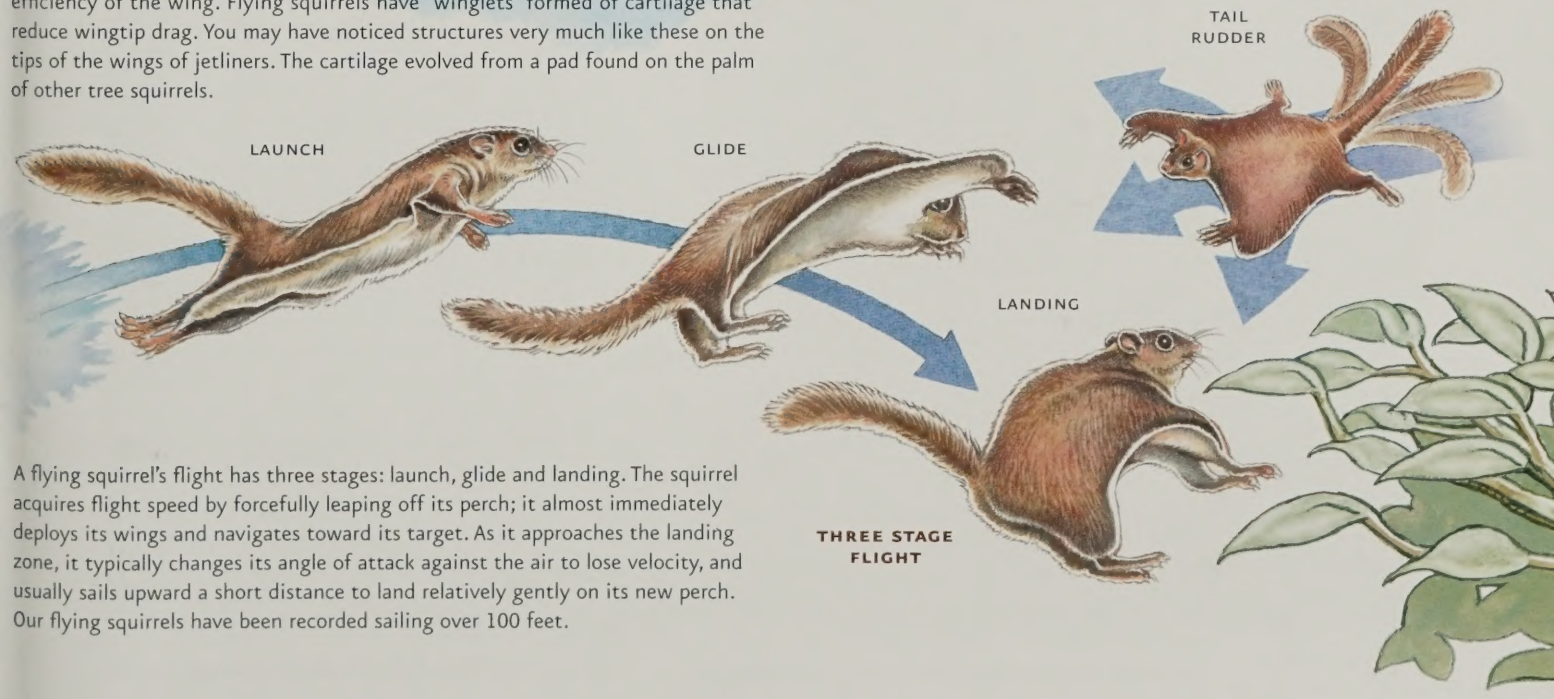
written by Clyde Sorenson
illustrated by Jim Brown

FLYING SQUIRRELS, LIKE FLYING FISH, FLYING LIZARDS, FLYING SNAKES (yes, there is such a thing) and flying frogs, don't actually fly. Instead, they glide, propelled only by their launch velocity. They don't passively sail through the air like a paper airplane or whiffling leaf; instead they exquisitely control their flight and fall. Flying squirrels have several adaptations that allow them to go exactly where they want.

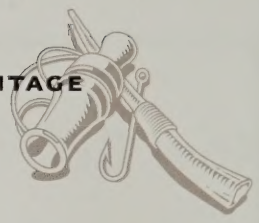
The flying squirrel's wing has several components. The main body of the wing is formed with a membrane that stretches from the foreleg to the hind leg, called the patagium. It's not just a flap of skin but contains sheets of muscles that allow the animal to change the shape and tension in the wing. This gives the squirrel the ability to change the shape of its airfoil, to help steer and adjust its rate of fall.

Wing tips moving through air generate turbulence that creates drag, reducing the efficiency of the wing. Flying squirrels have "winglets" formed of cartilage that reduce wingtip drag. You may have noticed structures very much like these on the tips of the wings of jetliners. The cartilage evolved from a pad found on the palm of other tree squirrels.

The hind legs and flat tail of the squirrel create its rudder and flaps, providing extreme maneuverability. A flying squirrel can change its flight direction up to 180 degrees.



A flying squirrel's flight has three stages: launch, glide and landing. The squirrel acquires flight speed by forcefully leaping off its perch; it almost immediately deploys its wings and navigates toward its target. As it approaches the landing zone, it typically changes its angle of attack against the air to lose velocity, and usually sails upward a short distance to land relatively gently on its new perch. Our flying squirrels have been recorded sailing over 100 feet.



Blindfolded, with Scissors

written by Jim Dean

To honor the memory of our colleague and friend, Wildlife in North Carolina *will publish our favorite Jim Dean columns for the remainder of 2018. "Blindfolded, with Scissors" was originally published in March 1993.*

This is a story about a crab, sort of. We were at the beach and decided that we wanted some blue crabs steamed Maryland-style. We went to the sound where it was simple enough to catch the crabs by tying weighted fish heads to string and tossing them into the water along the edges of deeper cuts and around piers. We landed the crabs with long-handled nets.

Back at the cottage, we iced down the crabs to keep them alive and also to make them inactive. We put several inches of vinegar—you can also use beer—in the bottom of a large pot, and dropped in a rack to keep the crabs out of the liquid. Then we began filling the pot with layers of live crabs, sprinkling each layer liberally with flake salt and Old Bay seasoning. Old Bay works fine if you can't get special seasonings from a Baltimore or Eastern Shore crab house.

We kept adding layers of live crabs and seasoning until the pot was filled, then put the lid on so we could steam them quickly. Or tried to. The pot was too full. We rearranged the top layers of crabs several times, but it soon became clear that we had exactly one crab too many.

"Oh well, then take one out," someone said with exasperation. I gingerly grasped a crab by the back flipper, avoiding its claws. There seemed to be only one thing to do with it. I carried it out the door and down to the beach. There, I washed off the salt and seasoning, then watched as one blue crab, lucky beyond knowing, scuttled out to sea.

I think of that crab from time to time. He—it was a male—seems to represent the random, often whimsical, and utterly capricious nature of life. Who stays in the pot? Who gets a reprieve? And, like the crab, how often do we survive a close shave without even knowing it? Daily? More often?

I'm not sure that hunters or fishermen face threats more frequently than anyone else, but ours are more inventive. Not long after the incident with the crab, I was fishing with a friend in a borrowed boat near Harker's Island. It was one of those handsome, lap-straked, wooden Barbour outboards that were so popular during the late 1950s and early '60s. This one had seen better days, however, and we were not surprised that the boat seemed to be leaking. No cause for alarm, we figured, because we could bail it out if it got too deep. We continued fishing. As usual, I was puffing on my pipe, and my companion was smoking cigarettes.

By mid-afternoon, we began to smell gas—not much at first, and besides, all motorboats smell like gas. We kept fishing until the floorboards were awash. When my companion began to rummage around in the bilges looking for something to use as a bailer, he made a hair-raising discovery. A seam had split in the 18-gallon tank. We had been wading ankle deep in gasoline for at least an hour. Since we were both smoking, we were little more than a pair of Molotov cocktails with short fuses.

To this day, I don't know why our crisp body parts weren't found all over Cape Lookout, but somehow we got our smokes extinguished, patched the tank and bailed most of the gasoline. Even as we cautiously headed in, my companion was prepared to ride his lucky streak, and jokingly wondered whether it might be possible to let himself out behind the boat on a tethered cushion so he could safely light up.

On another occasion, I left a well-marked mountain trail to take a rugged short-cut down to the trout stream I planned to fish. While on my hands and knees trying to extract my fly rod from some especially thick rhododendron, I put my foot out to stand up and found that it was hanging over the edge of a well-hidden 400-foot precipice. Had I not snagged my line on the rhododendron, I believe I would have walked right out into mid-air just like Wile E. Coyote. In both those instances, I became aware of the danger, but maybe it's best we don't know how often we are spared—that the driver we just passed has a snoot full and is going to hit the very next car head-on.

"Small wonder we grow cautious as we grow older. We may have less to lose with each passing day, but we are increasingly loathe to lose it."

Small wonder we grow cautious as we grow older. We may have less to lose with each passing day, but we are increasingly loathe to lose it. We have seen too many mindless crabs scuttle to sea. We drive slowly and keep both hands on the wheel. We look before we leap, then often don't leap. We count no chickens before they hatch; indeed, we are unwilling to acknowledge that any have ever hatched.

Be kind if you see someone wading a trout stream with unnecessary care or wearing enough blaze orange to be visible from a satellite. It might be me, or someone else who's learned that we run blindfolded through life carrying sharp scissors.

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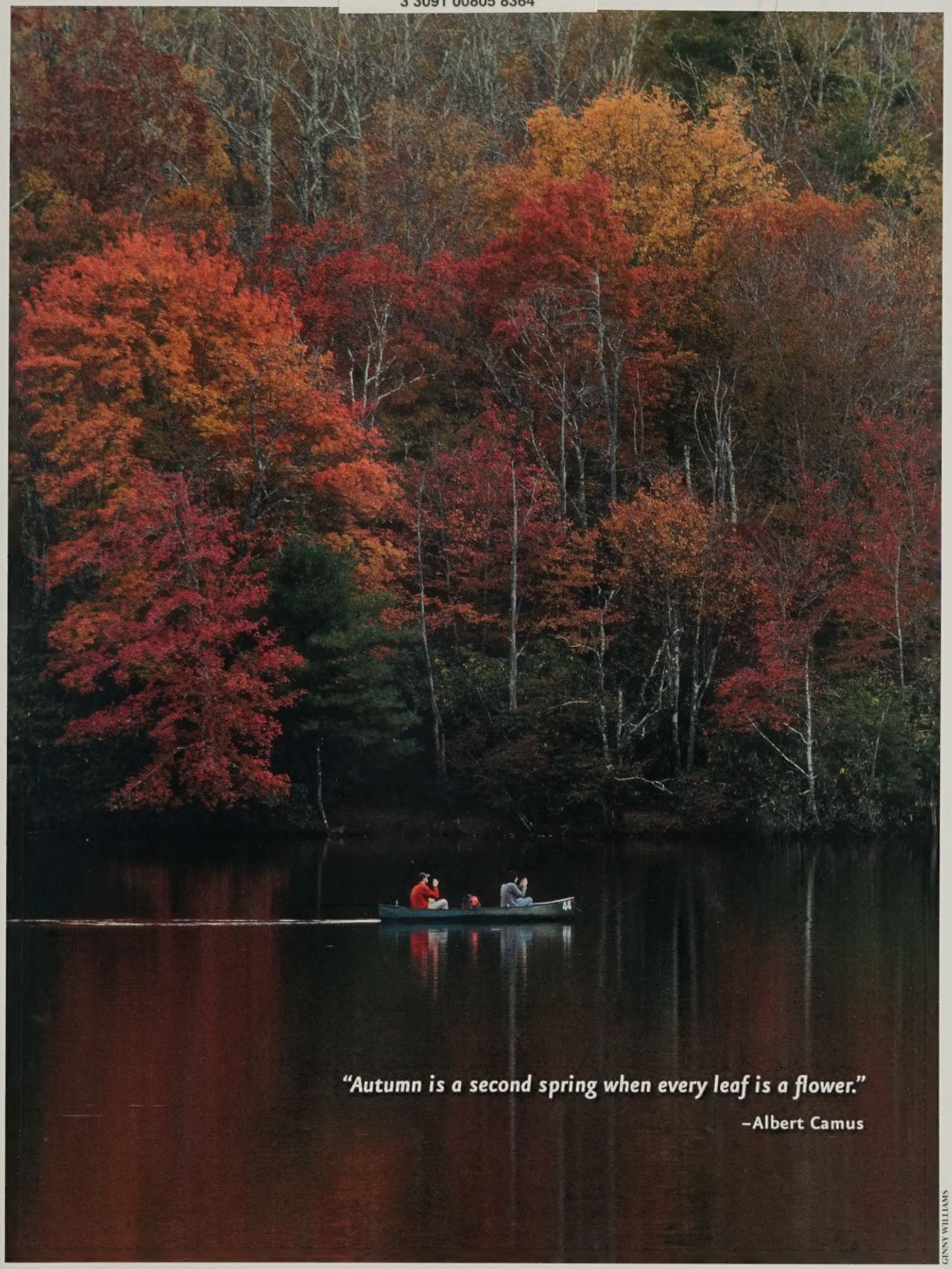

OUTDOOR MOMENT

Canoe on Price Lake

IN THE NOVEMBER • DECEMBER ISSUE

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